CLEAN DEVELOPMENT MECHANISM
PROGRAMME OF ACTIVITIES DESIGN DOCUMENT FORM
(CDM-PoA-DD) Version 01

CONTENTS

NOTE:

This form is for the submission of a CDM PoA whose CPAs apply a large scale approved methodology.

At the time of requesting registration this form must be accompanied by a CDM-CPA-DD form that has been specified for the proposed PoA, as well as by one completed CDM-CPA-DD (using a real case).

SECTION A. General description of programme of activities (PoA)

A.1 Title of the programme of activities:

Sustainable Small Hydropower Programme of Activities (PoA) in Viet Nam
Version: 4.0
Date: 20 August 2012

A.2. Description of the programme of activities:

1. General operating and implementing framework of PoA

Programme of Activities (PoA) under the CDM often referred, as "Programmatic CDM" is a framework covering similar projects that can be registered as a single CDM project activity. The "Sustainable Small Hydropower Programme of Activities (PoA) in Viet Nam", later on referred as the "Viet Nam Small Hydro PoA", will consist of CDM Programme Activities (CPAs) that each represents one or more small-scale hydropower plants built in Viet Nam with an installed capacity of up to 30MW[1]. The Viet Nam Small Hydro PoA is a voluntary action being coordinated and managed by Vietnam PoA Carbon Management Joint Stock Company (subsequently referred to as Coordinating/Managing Entity - CME), a company registered in Viet Nam.

2. Policy/measure or stated goal of the PoA

Viet Nam has a large hydropower potential that could be sourced as renewable energy for small hydropower plants. In the face of growing demand for electricity, small hydropower development should also be one attractive solution towards meeting the demand in an environmentally sustainable manner. However, in spite of abundant potential and high demand[2], investors in development of small hydropower plants still face several difficulties[3] even though the Vietnamese government[4]has encouraged every kind of entities (including private entities) to invest in such small hydropower projects.

Electricity of Viet Nam (EVN), through dependent finance power companies (No1, No 2 and No 3), still maintains and consolidates its monopoly role[5] in buying electricity generated from these projects. Therefore, Independent Power Producers (IPPs) are facing big challenges to get Power Purchase Agreement, which increase their transaction costs, which must be added to high costs for getting permits and clearances besides large investment costs that must be covered by IPPs. The high costs and unclear revenues could decrease the financial attractiveness of hydropower development, which in turn prevents IPPs from entering the market. The CDM as defined in the Kyoto Protocol can contribute to financing such hydropower projects, which could provide an incentive for IPPs to enter the hydropower industry.

[1] Decision No 3454/QD-BCN issued by Ministry of Industry on 18 October 2005, hydropower projects having installed capacity within the range from 1 to 30 MW are categorized as small scale projects, in Viet Nam.

[2] http://tietkiemnangluong.com.vn/home/hoat-dong-chuong-trinh/thuy-dien-nho-tiem-nang-con-bo-ngo-8003-7794.html

[3] http://www.vncold.vn/Web/Content.aspx?distid=924

[4] Prime's Minister Decision No 176/2004/QD-TTg dated 05 October 2004 on approval the development plan of Viet Nam power sector for the period of 2004 – 2012 with perspectives to 2020.

[5] http://vietbao.vn/Kinh-te/Tong-cong-ty-Dien-luc-VN-doc-quyen-mua-re-ban-dat/10732642/87/

The objective of the Viet Nam Small Hydro PoA is to develop a platform for supporting the development of small hydropower projects in Viet Nam. To reach this goal the CME will provide the following services across Viet Nam:

- raise awareness among local stakeholders of climate change and renewable energy. To ensure maximum stakeholder involvement CPAs will be developed according to the Gold Standard requirements and will include significant public education and consultation components
- raise awareness among Viet Nam's hydropower developers of opportunities for generating CDM revenues. To this end the CME will conduct capacity building sessions across the country that explain the CDM and support entrepreneurs in integrating CDM into their hydropower projects in order to improve the financial viability of such projects.
- provide standardized and streamlined access to CDM services for the hydropower projects in Viet Nam, including the smallest ones that otherwise would not be able to generate into CDM revenues. To this end CME will coordinate the inclusion of the CPA in the PoA; conduct the registration of the CPA as a Gold Standard activity (if applicable); provide monitoring and verification services to all CPAs; and support the effective commercialization of CERs. Over time additional services will be added to support the effective development of the hydropower sector across Viet Nam.

In this way the proposed PoA will promote the development of renewable energy and facilitate the abatement of greenhouse gas emissions through replacement of fossil-fuel based electricity.

Contribution to Sustainable development:

Environmental sustainability

- The PoA encourages hydropower utilization to generate electricity, which otherwise would have been generated through alternate fuels (most likely fossil fuels) based power plants, contributing to reduction in specific emissions (emissions of pollutant/unit of energy generated) including GHG emissions.
- As a hydropower project activity, each CPA produces no end products in the form of solid waste (ash, etc.), it addresses the problem of solid waste disposal encountered by most other sources of power.
- Being a renewable energy source, hydro energy used to generate electricity contributes to resource conservation and reduces reliance on exhaustible fossil fuel based power sources as well as the need to import fuels for the purpose of power generation.
- Thus, the PoA contributes to environmental well being across Viet Nam.

Economic sustainability

In recent years, Viet Nam has suffered a critical electricity shortage as a consequence from rapidly increasing demand and insufficient supply, thereby imposing negative impacts on economic growth[6] as well as on daily lives of people[7]. This PoA will support CPAs that contribute directly towards balancing the supply and demand gap. By exporting electricity directly to the national grid, the CPAs included in this PoA will help to reduce electricity losses across the national grid and to lessen the risks of cascading national grid collapse due to overload.

Moreover, the PoA

- Increases employment opportunities in the area where the CPA is located, which will give an increase in local community's income in general;

[6] http://www.uni-bros.com/en/news.php/power_shortages_deter_investors/id=17958/cid=4

[7] http://giadinh.net.vn/28083p0c1000/mat-dien-thuong-xuyen-tren-dien-rong-nguoi-dan-bi-tra-tan.htm

- Will facilitate the industrialisation process through the provision of stable power and enhance the local investment environment and thereby improve the local economy;
- Diversifies the sources of electricity generation, important for meeting growing energy demands and the transition away from diesel and coal-supplied electricity generation;
- Contributes to poverty alleviation through income and employment generation: the CPA will employ people throughout project operation.
- Through its CPAs will contribute towards the tax revenues of the provinces in Viet Nam.

Social sustainability

- The CPA would lead to the development of the region.
- During civil work, the CPA is expected to generate considerable employment opportunities for the local population.
- Other than these, there are various kinds of mechanical work, which would generate employment on regular and permanent basis.

Technology sustainability

- Modern turbines and generators will be used under this PoA, which in turn will accelerate the deployment of renewable energy technologies in Viet Nam.
- The PoA supports technological and know-how transfer from other regions or even other countries through trainings and practical works.
- The PoA encourages in promoting local products developed in the region when spare parts replacement is needed to support renewable technology development especially for hydropower technology which are available and made by local companies.

In conclusion the PoA will contribute positively towards sustainable development and be consistent with the energy policies set by the Government[8] of Viet Nam. Therefore, it satisfies the sustainable development criteria for CDM projects set by the DNA of Viet Nam.

3. Confirmation that the proposed PoA is a voluntary action by the coordinating/managing entity

The Viet Nam Small Hydro PoA is a voluntary action being coordinated and managed by Vietnam PoA Carbon Management Joint Stock Company (CME). There are no mandatory laws or regulations in place in Viet Nam that require hydropower plants to seek CDM services. Likewise, no mandatory laws or regulations exist requiring the CME or any other party to develop a PoA for hydropower plants in Viet Nam.

A.3. Coordinating/managing entity and participants of POA:

Vietnam PoA Carbon Management Joint Stock Company will be the Coordinating/Managing Entity[9] (CME) for the project activities under the Programme of Activities (PoA) and communicate with the CDM Executive Board.

[8] To encourage the investment in exploitation of renewable energy resources in Viet Nam, the project "Strategies and master plans for renewable energy in Viet Nam for the period up to 2015 with the perspectives up to 2025" is being implemented by the Ministry of Trade and Industry since 2007

[9] The Coordinating/Managing Entity shall be a project participant authorized by all participating project owners and the host country DNA and identified in the modalities of communication to serve as the entity which communicates with the Executive Board, including on matters relating to the distribution of CERs.

Name of Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Viet Nam (host)	Vietnam PoA Carbon Management Joint Stock Company	No
Switzerland	South Pole Carbon Asset Management Ltd.	No

A.4. Technical description of the programme of activities:

A.4.1. Location of the programme of activities:

A.4.1.1. Host Party(ies):

Viet Nam

A.4.1.2. Physical/ Geographical boundary:

The proposed PoA will be developed within one country only, Viet Nam, with its capital city Hanoi. Viet Nam is located in South East Asia that lies along the Indochinese Peninsula and circles the old south eastern part of the Asian continent with its back turned to the Eastern Sea (Pacific Ocean). The location of which the CPAs will be implemented within the following co-ordinates[10]:

Latitude: 8°10' - 23°24'N

Longitude: 102°09' - 109°30'E

A map indicating the location of the PoA is provided in fig. A.1.

[10] http://www.chinhphu.vn/cttdtcp/en/about_vietnam08.html

Fig 1. Map of Viet Nam

A.4.2. Description of a typical CDM programme activity (CPA):

A.4.2.1. Technology or measures to be employed by the CPA:

A typical CPA under this PoA comprises one or more small hydropower plants, as defined under Vietnamese regulation[11], that are constructed by one or more third-party project owners. The CPAs may use different hydropower technologies to convert kinetic energy of water to generate electricity, which may include technologies (but not limited to) as Pelton, Kaplan, Turgo, Francis turbines etc. The technologies employed in each CPA may differ from one CPA to the next, and may comprise *inter alia* barrages, diversion tunnels, fore bays, spillways, pressure pipes, powerhouses, and booster stations. The detailed technical characteristics will differ across CPAs and be described in the corresponding CPA-DDs. The electricity generated by under a CPA will be transmitted to the closest grid connection available in area where the hydropower plants covered by the CPA are located.

[11] Ibid at 1

A.4.2.2. Eligibility criteria for inclusion of a CPA in the PoA:

A CPA to be included in the proposed PoA shall:

i. Comprise one or more newly developed grid-connected hydro power plants located within the geographical boundary of Viet Nam.

ii. Have a maximum installed capacity below or equal to 30 MW to be qualified as a small hydropower plant under Vietnamese regulations.

iii. Be uniquely identified project which is neither registered as a CDM project activity nor included in another registered PoA to avoid double counting of emission reductions.

iv. Use newly built equipment to generate electricity from hydro power.

v. Have start date after validation start date. Validation start date is defined as the date in which the PoA-DD, and generic and specific CPA-DDs were first uploaded to the UNFCCC website for public inputs (in accordance to EB 55, Annex 38, paragraph 7d) or in the case of the CPA having start date before validation start date, have start date between 22 June 2007 and validation start date and be included in the list that have been provided to UNFCCC for this PoA (in accordance to EB 47 Meeting Report, paragraph 72).

vi. Be in line with requirements in the approved consolidated baseline and methodology ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" version 12.3.0 for hydro power projects. The CPA shall meet the following sub-criteria:
   - not include any activities that consist of capacity additions, retrofits or replacements;
   - be a hydro power plant/unit either with a run-of-river reservoir or accumulation reservoir. In case the CPA utilizing new single or multiple reservoirs, the power density of each reservoir must be greater than 4 W/m2 with or without the volume increased
   - Not result in new reservoirs or in the increase in existing reservoirs where the power density of the power plant is less than 4 W/m2

vii. Have a cooperation agreement with the CME to participate in the PoA. The Agremment shall clearly state that CPA owner cedes its rights to claim and own emission reductions under the Clean Development Mechanism of the UNFCCC or any voluntary scheme to the CME of the present PoA.

viii. Additionality of GHG emission reductions is demonstrated in accordance to the "Tool for the demonstration and assessment of additionality", version 6.0.0. This means the CPA shall meet the following sub-criteria:
   - Demonstrate that the Project IRR is either less than the Commercial Lending rate or less than the Weighted Average Cost of Capital (WACC), in cases where the WACC is chosen as the appropriate Benchmark. It shall also be demonstrated that such conclusion is confirmed by a means of a sensitivity analysis.
   - CPA is not common practice in Viet Nam.

ix. Undertake stakeholder consultations and environmental impact analysis as per requirements of the CDM modalities and procedures as well as the relevant laws and regulations of Viet Nam.

x. Not result into the diversion of official development assistance or public funding.

The eligibility criteria described above and in section E.5.2 of the PoA-DD will be revised and updated, and the consequent changes will be included in a new version of the PoA-DD and new generic CPA-DD validated by a DOE, and shall submit it to the Board for approval. in the following events:

- If the applied methodology is revised or replaced, subsequent to being placed on hold.
- If the boundary of the PoA is amended post-registration to expand the geographic coverage or to include an additional host Party/ies.

- If the revision of eligibility criteria is requested by the Board at any time during the lifetime of the PoA.

  (a) Once changes have been approved by the Board, the inclusion of all new CPAs shall be based on the updated eligibility criteria applying the new generic CPA- DD;

  (b) CPAs that were included before the methodology was put on hold shall apply the revised version of the generic CPA-DD only at the time of the renewal of the crediting period.

- At the renewal of the crediting period of a PoA (at the renewal of the first CPA), the CME shall update the eligibility criteria as per the latest revised applicable methodology and include them in a new version of the PoA-DD and new generic CPA-DD validated by a DOE, and shall be submitted to the Board for approval.

No action will be required if the version of methodology/ies applied by the PoA is revised without being placed on hold or is withdrawn for the purpose of inclusion in a consolidated methodology/ies unless otherwise indicated in the respective report of the meeting of the Board that has approved the new methodology/ies.

A.4.3. Description of how the anthropogenic emissions of GHG by sources are reduced by a CPA below those that would have occurred in the absence of the registered PoA (assessment and demonstration of additionality):

The following information presents the demonstration of additionality of the PoA as a whole while information regarding the additionality of each CPA will be presented in section E.5:

(i) The proposed PoA is a voluntary coordinated action

The proposed PoA is a voluntary and coordinated action, which will raise public awareness on CDM, renewable energy and climate change in the hydropower sector; coordinate small hydropower plants in Viet Nam to adopt more sustainable practices and seek for carbon finance services; and promote the consultation of local stakeholders in related with CDM. In doing so the PoA will encourage the deployment of renewable energy electricity generation in the country. There are no mandatory laws or regulations in Viet Nam stipulating to have recourse to CDM to develop hydropower facilities.

(ii) If the PoA is implementing a voluntary coordinated action, it would not be implemented in the absence of the PoA;

In the absence of the proposed PoA, the voluntary coordinated actions outlined above will not be implemented. In the absence of the capacity development and streamlined CDM services proposed under this PoA the total number of registered Vietnamese hydropower CDM projects is hence expected to remain below potential.

According to the Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities (version 01.0), "additionality shall be demonstrated by establishing that in the absence of CDM, none of the implemented CPAs would occur". As per paragraph 73 of the 47th EB meeting report "additionality is to be demonstrated either at the PoA level or at CPA level". Due to the specificity of every hydro power project, the PPs choose to demonstrate the Additionality at CPA level as per the requirements of the "Tool for the

demonstration and assessment of additionality" (version 06.0.0). Refer to section E5 of this PoA-DD.

(iii) If the PoA is implementing a mandatory policy/regulation, this would/is not enforced;

Not applicable, there are no mandatory policies/regulations in Viet Nam that require the implementation of the PoA or the activities that it promotes.

(iv) If mandatory a policy/regulation is enforced, the PoA will lead to a greater level of enforcement of the existing mandatory policy/regulation.

Not applicable.

A.4.4. Operational, management and monitoring plan for the programme of activities:

A.4.4.1. Operational and management plan:

The proposed PoA involves a range of operational activities in order to implement and manage each CPA by the CME and CPA owner within the PoA.

Entity	Management Responsibilities and Arrangements
CME	• Identification of Project Activities to be included in the PoA • Contractual arrangements with Project Entities ensuring compliance with the PoA eligibility criteria described in this document. • Preparation and updating of PoA and CPA DDs • Collection of documents and supporting evidence required for validation of the PoA, inclusion of CPAs as well as verification of CERs • Communication with the CDM Executive Board, including communication on matters related to the registration process and issuance process, distribution of CERs and change of project participants • Implementation of a database allowing for a transparent and unambiguous management of information related to the PoA and its underlying CPAs • Maintain existing relationship with the project owner (e.g. conduct training for data monitoring) • Periodic collection of monitoring data • Preparation of monitoring reports for emission reduction verification
CPA owner	• Implement hydropower plant project activity (conducting the feasibility study, investment, people consultation, construction, daily operation, and maintenance of hydropower plant) • Preparation of monitoring data according to the guidelines set in the generic CPA-DD • Facilitate the CME and DOE required documents and access to site as needed

In addition to the above management tasks, CME will implement the following operational elements to ensure proper management and oversight of the proposed PoA.

(i) A record keeping system for each CPA under the PoA
In order to unambiguously identify hydropower plant participating in the PoA a serial numbering system will be implemented that uniquely identify each hydropower plant through numbers for the CPA and the hydropower facility. This serial numbering system will be used to record baseline and monitoring data on a continuing basis using an Excel database. In this way the CME will be able to track the emission reduction of each hydropower plant over the full duration of the crediting period.

Each CPA will follow the record keeping and monitoring requirements stipulated in the applied methodology. The CME will record and document CPA detail information as follows:

- Name of the CPA and its installed capacity
- The name, address, and project owner details of each participating CPA
- The geographical coordinates of each CPA (GPS coordinates of the power house)
- The record of technical specification of each hydropower plant participating in the CPA
- The verification status (number of verification and associated monitoring period)
- Emission reductions monitored and issued each in monitoring period

CME will be responsible for the management of records and data associated with each CPA. The Excel database will be updated manually using the data supplied by the participating hydropower plants. It will form the basis for the verification of CPAs and be available for inspection by the DOE at any point in time.
The Carbon Project Management Tool (PMT) is the project management software to monitor the PoA pipeline. This system is a browser-based application running on a web server and is accessible from any computer with Internet access.

Connections between users and the web server are secured with 256-bit SSL encryption. The backend is an apache web server, the web application is written in PHP5, and data is stored in a mySQL database. Utilizing mainstream open source technology, South Pole Carbon Asset Management Ltd. (South Pole), as the service provider, guarantees the CME flexibility and reliability with regards to development and maintenance.

The PMT's server architecture guarantees that all data is kept consistent and always up to date for each user. The separation of presentation and data allows for flexible interfaces with other applications, easy data export and automated backups of sensitive and valuable project data.

The PMT can be used to track individual projects under various standards, with different credit types and crediting periods, as well as groups of projects or entire pipelines of projects, such as a PoA. On the project level, tools such as milestone management, a sophisticated comment and notification system to facilitate communication between different team members, deadline alerts, etc. allow project managers and supervisors to meet targets and deadlines and monitor or project both past and future amount of emission reductions resulting out of a project.

One level above, various features allow grouping and manipulating several projects together, with combined overviews on milestone deadlines, generated emission reductions, and applied standards.
Data can be directly exported to Excel from within the PMT, both for individual projects as well as for the PoA to run custom evaluations or to visualize data.

The PMT is hosted on a server in the EBM datacenter (www.ebm.ch) in Basel, Switzerland with very high service availability. The datacenter employs redundant network connections and electricity providers and is ISO9001/ISO 14001 certified. It also employs energy efficiency measures such as a clever climate management. Surveillance happens 24 h/365 days per year.

Following selection of screen shots shows just a few of the many functions of the PMT and the interface that will be shown for the PoA. Sensitive data from a live system has been blurred out. The project-related information shown has been taken from fictional projects inserted into the PMT Trial version.

Projects Overview holds most relevant information at one glance. The map can be exported to Google Earth, key data can be exported to Excel.

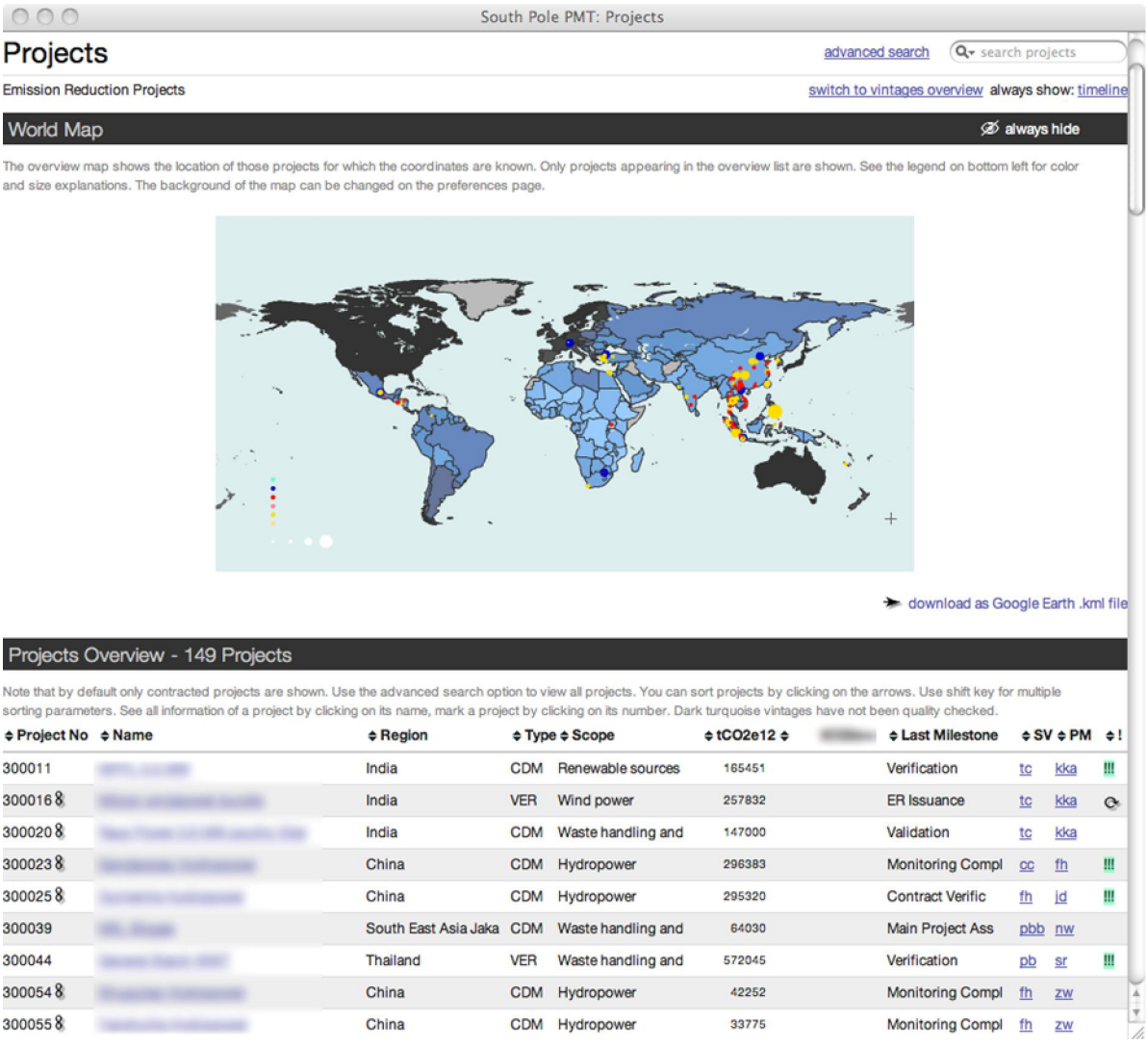

Fig 2: Project Overview

The Milestones Overview shows at first glance which projects are behind schedule. All tables show the same projects – if one project is marked in a table, it will be marked in all tables. Which projects are shown in the overview depends on the outcome of a search query. Per default, only active contracted projects are shown.

Milestones Overview — always hide

Date colors: black = pending, pink = approaching, red = overdue. Dashed underline: to be confirmed as closed.
Background colors: pink = initial due date was earlier than new due date (=discrepancy), red = discrepancy over 90 days. If the management approval team denied working on a milestone, it will have a red line on the top.
Milestones both showing a hook and a date signify that the project has a closed milestone of this sort already, but a new milestone is due at the date shown.

Project No	Name	EA	IPA	ERPA	MPA	PDD	DNA	Val.	MCC	Reg.	Ver.	Iss.
300011	[redacted]	✓		✓		✓	✓	✓		✓	2010-09-30	2010-12-31
300016	[redacted]	✓	✓	✓		✓		✓		2010-07-01	2010-09-30	2010-10-31
300020	[redacted]	✓	✓	✓	✓	✓	✓	✓		2010-06-15	2011-05-31	2011-09-30
300023	[redacted]	✓		✓	✓	✓	✓	2010-02-12	2010-09-15	2010-06-30	2010-12-31	2011-02-28
300025	[redacted]	✓		✓	✓	✓	✓	✓		✓	2010-06-30	2010-06-30
300039	[redacted]	✓	✓	✓	✓	2010-03-31	2010-05-31	2010-08-05			2012-12-31	undefined
300044	[redacted]			✓		✓		✓	2010-06-30	✓	✓	2010-03-31
300054	[redacted]	✓		✓	✓	✓	✓	✓	✓	2010-07-31	2010-11-30	2010-12-30
300055	[redacted]	✓		✓	✓	✓	✓	2010-02-26	✓	2010-07-31	2010-11-30	2010-12-30
300057	[redacted]	✓	✓	✓		✓		✓			2010-11-30	2010-12-10
300059	[redacted]	✓		✓		✓	✓	✓		2010-04-30	2010-05-31	2010-07-31
300062	[redacted]	✓	✓	✓	✓	✓		✓		✓	2010-10-31	undefined
300063	[redacted]	✓		✓	✓	✓	✓	✓		2010-07-31	2010-12-31	2011-01-31
300065	[redacted]	✓		✓	✓	✓	✓	✓	✓	2010-05-31	2011-03-31	2011-04-30
300067	[redacted]	✓		✓	✓	✓	✓	✓	2010-08-01	2010-05-31	2011-03-31	2011-04-30
300068	[redacted]	✓	✓	✓	✓	✓	✓	✓	✓	2010-06-04	2010-10-01	2010-11-01
300070	[redacted]	✓	✓	✓	✓	✓		✓			2010-10-31	2010-12-31

Fig 3: Milestone Overview

Milestone totals are shown at the end of the table.

	EA	IPA	ERPA	MPA	PDD	DNA	Val.	MCC	Reg.	Ver.	Iss.
Total milestones initially expected to be closed	[redacted]										
Total milestones closed	[redacted]										
Total closed (only 1 per project)	[redacted]										
Average days needed after ERPA	[redacted]										

Fig 4: Milestone Totals

For PoAs, vintage packages of the corresponding CPAs are displayed automatically in the PoA vintage package information. A vintage package cannot be added directly at the PoA level.

Vintage Packages

advanced search

Emission Reduction Vintages

switch to projects overview

Vintages Overview - 16 Packages

The numbers show available credits (expected plus issued minus assigned or delivered). Dark turquoise vintages have not been quality checked.

scroll back scroll ahead

Package	Type	Project	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
300001 - A	CER	4.5 MW Biomass	0	0	0	0	23500	23500	23500	23500	23500	0
300004 - A	GS VER	Windpower Bundle	0	0	0	0	0	0	0	0	0	0
300006 - A	CER	6 MW Poultry Litter	0	0	0	0	0	0	0	0	0	12300
300009 - A	GS CER	Shuangxing Hydropower	0	0	0	0	0	0	0	0	0	111000
300009 - B	VCU	Shuangxing Hydropower	0	0	0	0	0	0	0	0	100000	0
300011 - A	CER	Menna Hydropower	0	0	0	0	0	0	0	10000	259000	103000
300012 - A	VCU	20 MW Wind	0	0	0	0	0	0	3450	52345	53445	0
300013 - A	VCU	Starch WWT	0	0	0	0	0	0	10022	11003	11004	11000
300014 - A		Mex Distillery WWT	0	0	0	0	0	0	0	0	12333	40000
300014 - B	VCU	Mex Distillery WWT	0	0	0	0	0	0	0	0	0	0
300017 - A	VER+	Riogrande Hydroelectric Project	0	0	0	0	0	87099	87099	87099	87099	87099
300018 - A	GS VER	Taipei Wind farm	0	0	0	0	0	0	0	0	0	100000
300019 - A	GS VER	Polyester Biomass	0	0	0	0	0	0	0	0	22333	25000
300020 - A	GS VER	Tapioca WWT	0	0	0	0	0	0	31222	31222	31222	31222
300023 - A	CER	Agave Compost	0	0	0	0	0	0	0	0	1600	2300
300024 - A	VCU	Aisen Waste Gas Recovery	0	0	0	0	0	0	287964	287964	287964	287964

Fig 5: Vintage Package

(ii) A system/procedure to avoid double accounting e.g. to avoid the case of including a new CPA that has been already registered either as a CDM project activity or as a CPA of another PoA,

The database described above will be used to perform a double accounting check. Every new CPA will be compared to the already existing database and the list of project activities that are under validation or registered at the UNFCCC or CPAs that have been included in any other registered PoA. Moreover as shown below, the CPA owners will be made aware of the double accounting principle and will certify that the proposed CPA is neither registered as a CDM project activity nor included in another registered PoA under the Clean Development Mechanism of the UNFCCC or any voluntary scheme. Should such a case occur then the CME will not proceed with inclusion of the corresponding CPA in the PoA.

(iii) The provisions to ensure that those operating the CPA are aware of and have agreed that their activity is being subscribed to the PoA;

To ensure that those operating the CPA are aware of and have agreed that their activity is being subscribed to the PoA the CPA owner shall enter into a contractual arrangement with the CME including respective provisions that:

1. The CPA has not been and will not be registered as a single CDM project activity nor as a CPA under another PoA.
2. The CPA owner is aware that the CPA will be subscribed to the present PoA.
3. The CPA owner cedes its rights to claim and own emission reductions under the Clean Development Mechanism of the UNFCCC or any voluntary scheme to the CME of the present PoA.
4. The CPA owner certifies that the CPA is not registered under the Clean Development Mechanism of the UNFCCC or any voluntary scheme.

Using the unique identification for each participating CPA and the custom-tailored Carbon Project Management Tool, the PoA CME will confirm that a facility has not already been registered or entered validation as a CDM project activity or as a CPA of another PoA. Should such a case occur then the coordinating entity will not proceed with inclusion of the corresponding CPA in the PoA.

(iv) A clear definition of roles and responsibilities of personnel involved in the process of inclusion of CPAs, including a review of their competencies

The CME

The CME is responsible for technical review of inclusion of CPAs. The following technical documentation will be requested by the CME to the CPA Owner:

- Feasibility study
- Environmental Assessment Report (when required)
- Technical design documents
- Financial analysis

The CME will maintain close communications with the CPA Owner before the CPA is included in the registered PoA to ensure that the CPA is eligible under the PoA. Upon inclusion, the CME shall remain in communication with the CPA Owner, and gather information related to the performance of the project activity.

In order to ensure the quality of its CDM-related activities, and to ensure the correct monitoring of the performance of each CPA, the CME is supported by South Pole. CDM experts from South Pole will be assigned to check the features of potential CPAs and ensure that each CPA meets all the requirements and eligibility criteria to be included in the registered PoA.

The CME will also employ South Pole's web-based Project Management Tool to unequivocally keep track of the PoA and CPAs performance.

South Pole

South Pole is responsible of providing the CME, during the PoA lifetime, with guidance and technical assistance, including data control, management of information and Quality Assurance and Quality Control services. South Pole provides also technical support to the CME during the entire CDM PoA cycle including, but not limited to, guidance during the validation/registration process of the PoA as well as inclusion of CPAs and verification/issuance of CERs.

Through its RACI[12] approach and Project Management Tool (PMT), South Pole is responsible of providing the CME, during the PoA lifetime, with guidance and technical assistance in data control, management of information and Quality Assurance and Quality Control practices.

Roles and responsibilities of the CME and South Pole staff

The CDM implementation of each CPA as well as of the PoA will be carried-out based on the following diagram.

[12] Responsible, Accountable, Consulted, Informed. The RACI aproach is described below.

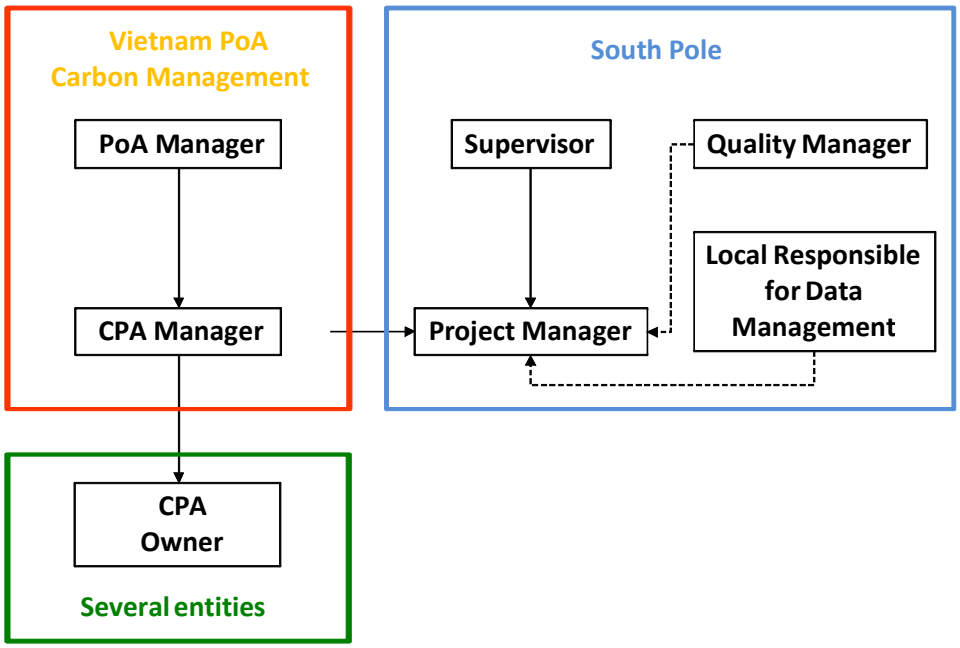

Fig 6: Implementation of a CPA

Roles and responsibilities of the CME's staff

For each CPA under this PoA, the CME, through the PoA Manager, will assign a CPA Manager, who will be supervised by the PoA Manager. The CPA Manager will be in close communication with the CPA Owner and with the South Pole appointed Project Manager.

Position	Responsibilities
PoA Manager	- CPAs contracting. - Preliminary Emissions reductions and carbon revenue estimation. - Initial CPA Eligibility Criteria compliance check. - Ensure high-quality implementation of all CPAs including the updates in the South Pole's PMT. - Coordination of Validation and inclusion of the CPA in the PoA. - Keep updated the PoA CPA Record Keeping System (PMT). - Train staff, set priorities properly, solves problems raised by the CPA Manager. - Quality control of implementation work. If necessary, reviews work of CPA Manager before submission to South Pole. - Ensure productive, efficient and inspiring working conditions for all employees. - Human Resource selection, negotiation of work contracts, proper assignment of targets and responsibilities, and conduction of evaluation process. - Ensure all administrative issues are properly dealt with, including accounting processes, office rent, legal registration / approvals, IT, social security, tax, compliance with local laws. - Managing liason with country DNA.
CPA Manager	- Inclusion of the CPA

	- Communications with the CPA Owner. - Ensure CPA complies with eligibility criteria and that all the relevant documentation required by the DOE to validate the CPA is provided. - Ensure that CPA-DD is written in a high quality manner. - Ensure that the CPA is implemented in accordance to the CPA DD. - Compiles from the CPA Owner the monitoring information and develops the monitoring report. - Identification of opportunities to improve work process and propose solutions to CME upper management. - Deployment of any improvements and monitoring of their impact. - Ensure that the CPA inclusion and implementation phases are adequately resourced.

Vietnam PoA Carbon Management Joint Stock Company will review the competencies of its personnel to be involved in CPA inclusions prior to their employment/assignment and will ensure that staff is properly trained with regards to specific CPA inclusion requirements. Personnel involved in CPA inclusion process shall have a background in engineering or natural sciences and experience in the renewable energy or environmental sectors.

Roles and responsibilities of the involved South Pole's staff

Project Manager (Responsible):

- Fully responsible for the data management of the PoA and CPA in PMT and for first quality checks of the PoA (whenever PoA-DD updating is required) and its associated CPAs (CPA-DD, stakeholder consultation, monitoring report, etc.)
- If corrections are needed, the Project Manager raises the issue with the CPA Manager and assists in providing a solution before document submission to the Quality Manager.

Supervisor (Accountable):

- Oversees and ensures high-quality implementation of all CPAs and the PoA through South Pole's RACI system and Project Management Tool.
- Reviews work of Project Manager before closure of milestone in PMT.

Quality Manager (Consulted):

- After a first revision is made and corrective actions are taken by the Project Manager, the Quality Manager (member of the South Pole's Global Quality Control and Technical Support Team) is responsible for all quality checks of the PoA and its associated CPAs (CPA-DD, stakeholder consultation, monitoring report, etc.).
- He also supports and advices the South Pole Project Manager to ensure that the project is built as described in the CPA-DD.

Local Responsible for Data Management (Informed):

- Ensures that the information is properly stored; ensures that the file names correspond to the CPA and that a standard nomenclature is used; and ensures that files, archives and registries are clearly organized.

(iv). Records of arrangements for training and capacity development for personnel

Training and capacity development activities for the CME will be carried-out to ensure that the CPA

Manager(s) as well as PoA Manager are fully qualified to implement this PoA and that are familiar with the EB latest guidelines related to PoA development, CPA inclusion, monitoring, verification and issuance. The training and capacity development activities for the CME staff shall be carried-out by experienced PoA South Pole staff, because of their deep knowledge of:

- The eligibility check,
- The additionality tests,
- The baseline estimation, and
- The monitoring guidelines and requirements, among others.

Training and capacity development activities for the CPA Owner will be carried-out with the purpose of ensuring correct monitoring as established in the CPA-DD. Training specific content and specific material (if applicable) will be adapted to each specific CPA, according to the technical specifications of each CPA, and to the characteristics of the equipment installed at each facility. It may be carried-out by the South Pole staff actively involved in this PoA, or by the CPA Manager.

(v). Records and documentation control process for each CPA under the PoA;

In order to ensure transparency and high-quality information managed during the PoA/CPA CDM cycle, the RACI approach developed by South Pole is employed. The "RACI" approach splits responsibilities for project management into the categories: Responsible, Accountable, Consulted and Informed.

Each step of the CDM project cycle at PoA level and at CPA level is broken down in individual milestones. Closing of milestones is based on a 4-eye principle according to the assignment of responsibilities. Quality checks (up to 8-eye principle) are enabled for key milestones.

For each step of the CDM project cycle and for each key activity in the PoA/CPA implementation process, such as "CPA eligibility check", the milestone closing procedure summarized below is followed.

- CPA Manager (Responsible) enters the milestone into the PMT.

- CPA Manager prepares project documentation, (such as the CPA-DD draft for the Initial Project Eligibility Assessment stage) and checks if assumptions and parameters applied and relevant sheets are consistent and justified by sources transparently. Prior the submission to the appointed South Pole Project Manager for review, the CPA Manager stores on the server all the applied documents and includes in the system the route in which all the information can be found.

- The South Pole Project Manager (Responsible) does a first quality check of all the documentation submitted by the CPA Manager. If corrections are needed, the Project Manager coordinates with the CPA Manager to take action before submission to the Quality Manager.

- South Pole Project Manager sets milestone as "requesting closure" and informs Quality Manager (Consulted).

- Quality Manager and Local Responsible for Data Management (Informed) check deliverables and comment on open issues. Commented documents are sent back to the South Pole Project Manager and to the CPA Manager if necessary. Such cycle might be repeated several times until sufficient quality is met.

- If deliverables reach sufficient quality the Local Responsible for Data Management inserts conclusion as comment in PMT milestone and the Quality Manager inserts main conclusions as comment in the specific milestone and stamps it.

- The Supervisor (Accountable) checks the outcome and agrees with Project Manager, Local Responsible for Data Management, and with Quality Manager by closing the milestone.

(vi). Procedures for technical review of inclusion of CPAs

The CME has the main responsibility for technical review of inclusion of CPAs, whereas South Pole provides technical support and quality control/quality assurance services for the inclusion process. All necessary documents to demonstrate compliance with the eligibility criteria of the PoA are collected and verified by the CME. The CME collects also all information and supporting evidences required to draft the CPA-DD.

The entire technical review process is managed through the sophisticated Project Management Tool software developed by South Pole, which is described above.

(vii). Measures for continuous improvements of the PoA management system

The management system is subject to a continuous review of its effectiveness which is aligned with a Continuous Improvement Philosophy. Such review spans the various elements and any procedures. The aim is to identify any shortcomings and correct them, as well as to seek to continuously improve the PoA's performance on all counts. All those involved are encouraged to raise any issues that they feel need to be corrected and suggest any means of improvement, and to communicate these to the PoA Manager. The PoA manager will then allocate resources and appoint the relevant staff, bearing in mind the nature of issued raised, to ensure that solutions are designed, tested and their effectiveness monitored, prior to being formally adopted.

A.4.4.2. Monitoring plan:

It is envisaged that there would be multiple CPAs under the PoA. Each CPA is to be verified individually. Thus there is no PoA level sampling to be considered. A monitoring plan for each CPA will be developed in accordance with the applied baseline and monitoring methodology at the CPA level as per section E.7 of this PoA DD.

The CME will submit CPAs for verification by the DOE pursuant to the sequence described below:
1- The CME will continuously update a list of all CPAs
2- The CME collects the monitoring information for all CPAs that will be verified and prepares one monitoring report for each CPA.
3- Assessment of the CPAs.
4- The total verified emission reductions by the PoA is computed

For verification purposes, the CME will follow the procedure described below:

1- Maintenance of a list of verification procedures to be applied to each CPA

The CME will develop and continuously update a list of CPAs. This will clearly and uniquely identify each CPA and gives further important information to build the basis in order to compile a monitoring report, such as the crediting period start date of each CPA.

2- Collection of monitored parameters and elaboration of the monitoring plan

The monitoring report will compile all required monitoring information for a CPA that will be verified by the DOE. This report will unambiguously set out the data relating to the emission reductions generated by each specific CPA during the monitoring period consistent with the requirements of this PoA-DD and the corresponding CPA-DD.

The monitoring plan for parameters included in section E.7.1 will be implemented for each CPA with assistance from the CME as follows:

- CPA owner will implement each CPA individually and monitor and record all parameters included in section E.7.1.
- The CME will provide guidance to CPA owner on how monitoring should be conducted and data should be collected in regards to emission reductions calculation.
- The CPA owners will provide data on monitored parameters included in section E.7.1 to the CME.
- The CME will document and store all parameters included in section E.7.1 provided by CPA owners in an electronic database, while primary data will be stored by CPA owner
- The CME review relevant monitoring documents, prepare the monitoring report, and provide the latter to the DOE.

3- Assessment of the CPAs

The DOE performs a desk review of the monitoring information of all CPAs and performs on-site assessments in accordance with the prevailing guidelines and rules.

At the end of the assessment, the CME shall provide an updated monitoring report elaborated in light of the DOE findings.

4-The total verified emission reduction by the PoA is computed

The DOE approves the final monitoring report provided by the CME and certifies that (i) the list and type of data collected and provided within the monitoring report is consistent with the monitoring plan of each CPA (ii) the ERs are estimated as described in this PoA-DD and the respective CPA-DD and are not miscalculated.

A.4.5. Public funding of the programme of activities:

The Viet Nam Small Hydro PoA does not receive any public funding.

SECTION B. Duration of the programme of activities

B.1. Starting date of the programme of activities:

23 December 2009 (date in which the period for public comments of the PoA-DD and generic and specific CPA-DDs started)

B.2. Length of the programme of activities:

28 years

SECTION C. Environmental Analysis

C.1. Please indicate the level at which environmental analysis as per requirements of the CDM modalities and procedures is undertaken. Justify the choice of level at which the environmental analysis is undertaken:

1. Environmental Analysis is done at PoA level ☐
2. Environmental Analysis is done at CPA level ☑

The highly localized and site-specific environmental impacts of each hydro project and sub-national environmental policies that may differ across Viet Nam justify a separate environmental assessment for each CPA. The environmental analysis for each CPA will be conducted in line with applicable environmental policies that will be identified in each CPA.

C.2. Documentation on the analysis of the environmental impacts, including transboundary impacts:

The environmental impact analysis will be done at CPA level

C.3. Please state whether in accordance with thehost Party laws/regulations, an environmental impact assessment is required for a typical CPA, included in the programme of activities (PoA),:

The currently effective laws and regulations on environmental impact assessment is the Environment Protection Law of Viet Nam 2005 (Article 18) and Decree No.21/2008/ND-CP dated February 28, 2008, which requires environmental impact assessment (EIA) for hydropower projects with reservoir's capacity of 300,000 m^3 or more of water. For CPAs to be included in the future in the PoA, the latest legal documents on EIA requirements available at the decision making time of the CPAs' owners will be applied. The findings of the respective EIA and details on any recommended mitigation measures to minimize the negative impacts and ensure the long-term benefits from a CPA shall be described in the corresponding CPA-DD.

SECTION D. Stakeholders' comments

D.1. Please indicate the level at which local stakeholder comments are invited. Justify the choice:

1. Local stakeholder consultation is done at PoA level ☐
2. Local stakeholder consultation is done at CPA level ☑

The highly localized and site-specific impacts of each hydro project require local stakeholder consultations to be carried out for each CPA at the CPA level.

D.2. Brief description how comments by local stakeholders have been invited and compiled:

Not applicable

D.3. Summary of the comments received:

Not applicable

D.4. Report on how due account was taken of any comments received:

Not applicable

SECTION E. Application of a baseline and monitoring methodology

E.1. Title and reference of the approved baseline and monitoring methodology applied to each CPA included in the PoA:

Name of approved baseline and monitoring methodology:

ACM0002 (version 12.3.0): "Consolidated baseline methodology for grid-connected electricity generation from renewable sources"

E.2. Justification of the choice of the methodology and why it is applicable to each CPA:

The applicability criteria of Version 12.3.0 of ACM0002 are the following:	Version 12.3.0 of ACM0002 is applicable to a CPA under the proposed PoA because:
1. The project activity is the installation, capacity addition, retrofit or replacement of a power plant/unit of one of the following types: hydro power plant/unit (either with a run-of-river reservoir or an accumulation reservoir), wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit;	1. A CPA under the proposed PoA will consist of a renewable energy generation plant/unit (hydro) that supplies electricity and displaces electricity from an electricity distribution system (the national grid) that would have been supplied by at least one fossil fuel fired generating unit (thermal power plants in the national grid).
2. In the case of capacity additions, retrofits or replacements (except for capacity addition projects for which the electricity generation of the existing power plant(s) or unit(s) is not affected): the existing plant started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity addition or	N/A. A CPA under the proposed PoA will not include any activities that consist of capacity additions, retrofits or replacements (see eligibility criteria in Section A.4.4.2).

retrofit of the plant has been undertaken between the start of this minimum historical reference period and the implementation of the project activity;	
3. In case of hydro power plants, at least one of the following conditions must apply: • *The project activity is implemented in an existing single or multiple reservoirs, with no change in the volume of any of the reservoirs; or* • *The project activity is implemented in an existing single or multiple reservoirs, where the volume of any of reservoirs is increased and the power density of each reservoir, as per definitions given in the Project Emission section, is greater than 4 W/m^2 after the implementation of the project activity; or* • *The project activity results in new single or multiple reservoirs and the power density of each reservoir, as per definitions given in the Project Emissions section, is greater than 4 W/m^2 after the implementation of the project activity*[2]*;* In case of hydro power plants using multiple reservoirs where the power density of any of the reservoirs is lower than 4W/m^2 after the implementation of the project activity all of the following conditions must apply: • The power density calculated for the entire project activity using equation 5 is greater than 4 W/m^2; • All reservoirs and hydro power plants are located at the same river and were designed together to function as an integrated project that collectively constitutes the generation capacity of the combined power plant; • The water flow between the multiple reservoirs is not used by any other hydropower unit which is not a part of the project activity; • The total installed capacity of the power units, which are driven using water from the reservoirs with a power density lower than 4W/m^2, is lower than 15MW; • The total installed capacity of the power units, which are driven using water from reservoirs with a power density lower than 4 W/m^2, is less than 10% of the total installed capacity of the project activity from multiple	3. A CPA under the proposed PoA will be a hydro power plant/unit either with a run-of-river reservoir or accumulation reservoir. In case the CPA utilizing new single or multiple reservoirs, the power density of each reservoir must be greater than 4 W/m^2 with or without the volume increased. (see eligibility criteria in Section A.4.4.2).

reservoirs.	
4. The project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity are NOT applicable, since in this case the baseline may be the continued use of fossil fuels at the site;	4. A CPA under the proposed PoA does not involve switching from fossil fuels to renewable energy sources at the site of the CPA.
5. Biomass fired power plants are NOT applicable;	5. A CPA under the proposed PoA shall not develop biomass fired power plants.
6. A Hydro power plant that results in the creation of a new single reservoir or in the increase in an existing single reservoir where the power density of the reservoir is less than 4 W/m ^{2} are NOT applicable.	6. A CPA under the proposed PoA excludes the hydro power plants that result in new reservoirs or in the increase in existing reservoirs where the power density of the power plant is less than 4 W/m^2 (see eligibility criteria in Section A.4.4.2).

E.3. Description of the sources and gases included in the CPA boundary

According to ACM0002 version 12.3.0, the spatial extent of the CPA boundary includes the CPA power plant and all power plants connected physically to the local grid that the CPA is connected to.

The greenhouse gases and emission sources included in or excluded from the project boundary are shown in the table below.

Table 1: Emissions sources included in or excluded from the project boundary

	Source	Gas	Included?	Justification/Explanation
Baseline	CO_2 emission from electricity generation in fossil fuel fired power plants that are displaced due to the CPA.	CO_2	Yes	Main emission source.
		CH_4	No	Minor emission source.
		N_2O	No	Minor emission source.
Project Activity	Emissions of CH_4 from the reservoir.	CO_2	No	Minor emission source.
		CH_4	Yes	Main emission source from plants in reservoir.[13]
		N_2O	No	Minor emission source.

E.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

According to the applied methodology, if the project activity is the installation of a new grid-connected renewable power plant, the baseline scenario is defined as the following:

> *"Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin calculations described in the "Tool to calculate the emission factor for an electricity system".*

[13] As per version 12.3.0 of ACM0002, this emission source only needs to be considered for CPAs that have reservoirs with a power density (PD) less than 10 W/m2

The Viet Nam national electricity grid, which is operated and monopolized by the EVN, is the unique transmission and distribution line, to which all power plants in Viet Nam are physically connected. Therefore the Viet Nam national electricity grid is the project electricity system.

Thus the baseline scenario of CPAs included in the Viet Nam Small Hydro PoA is the delivery of equivalent amount of annual power output from the Viet Nam national grid to which the proposed CPA is also connected. In the absence of the CPA, the clean energy generated by this proposed CPA would have been generated through non-renewable sources from Power Plants connected to the National grid, fostering the emission of greater quantities of green house gases.

The combined margin emission factor of the National grid will be calculated according to the "Tool to calculate the emission factor for an electricity system" version 02.2.1. The CO_2 emission factors for power generation in the National grid are calculated based on the database provided by EVN.

The analysis and description in E.5 and E6 will support the baseline scenario shown above.

E.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the CPA being included as registered PoA (assessment and demonstration of additionality of CPA):

E.5.1. Assessment and demonstration of additionality for a typical CPA:

Additionality shall be demonstrated for each CPA following the steps outlined in the "Tool for the demonstration and assessment of additionality" - version 06.0.0. For a technology that is as well established as electricity generation from hydropower in Viet Nam, financial barriers are the main barriers faced by project owners. As the CPAs generate financial benefits other than CDM-related income, investment analysis (benchmark analysis) will be used to demonstrate the additionality of each CPA followed by common practice analysis.

E.5.2. Key criteria and data for assessing additionality of a CPA:

According to Version 12.3.0 of ACM0002, the latest Version of the "Tool for the demonstration and assessment of additionality" shall be used to demonstrate the additionality of this project activity. Version 06.0.0 of the additionality tool will be applied for CPAs under this PoA.

Step 1: Identification of alternatives to the project activity consistent with current laws and regulations

Sub-step 1a: Define alternatives to the project activity

Paragraph 4 of version 06.0.0 of the additionality tool states: "Project activities that apply this tool in context of approved consolidated methodology ACM0002, only need to identify that there is at least one credible and feasible alternative that would be more attractive than the proposed project activity."Since only Greenfield hydropower projects are eligible under the Viet Nam Small Hydro PoA, each CPA will consider and analyze "continuation of the current situation" (no project activity or other alternatives undertaken) as a credible and feasible alternative to the project activities.

A CPA will therefore consider the following two alternatives in the assessment of additionality:
- Alternative 1: the proposed CPA is undertaken without the CDM
- Alternative 2: continuation of the current situation. In this case, the proposed CPA will not be constructed and the power will be solely supplied from the Viet Nam national grid.

Sub-step 1b: Consistency with mandatory laws and regulations

The "continuation of the current situation" alternative does not face any barrier from the current law and regulation in Viet Nam because it is the "do-nothing" alternative. The project owner of a CPA has no obligation to build or invest in the power plant to supply electricity for the local area. Hence this alternative is consistent with mandatory laws and regulations.

Step 2: Investment analysis

Sub-step 2a: Determine appropriate analysis method

Project activities proposed under CPAs that are eligible for inclusion in the Viet Nam Small Hydro PoA will generate financial and economic benefits other than CER revenues, so the simple cost analysis (Option I) is not applicable. Likewise, Option II (investment comparison analysis) is not applicable since the only alternative to the CPA is the "continuation of the current situation" alternative. So the appropriate analysis method for conducting the investment analysis is the benchmark analysis (Option III).

Sub-step 2b: Option III. Apply benchmark analysis

As indicated in Annex 5, EB 62: Guidelines on the Assessment of Investment Analysis, version 05, *"Local commercial lending rates or weighted average costs of capital (WACC) are appropriate benchmarks for a project IRR."* Therefore, based on the availability of published data inputs that constitute the benchmark at the time of investment decision, benchmark analysis for CPAs to be included in the PoA can opt for either local commercial lending rate or WACC approach. Regardless which approach is applied by the project participant, it shall be explained comprehensively in the CPA DD with sufficient references and be assessed in its totality by the DOE responsible for validation and inclusion of the CPA in question.

The benchmark calculated will then be compared to project IRR for additionality demonstration.

In case of CPAs using local commercial lending rates as a benchmarks for the project IRR

The benchmark should be derived from the average long-term lending rates available from the beginning of calculated year up to the date of decision making. All data is sourced from weekly reports published by the State Bank of Viet Nam on its official website (http://www.sbv.gov.vn/wps/portal/en).

In case of using WACC as a benchmarks for the project IRR

The project participant should apply the WACC equation to estimate the required return on capital as a benchmark for the project IRR as follows:

$$WACC = E * R_e + D * R_d * (1 - T_c) \qquad (1)$$

Where:

R_e : cost of equity

R_d : cost of debt

E : Average industry equity ratio

D : Average industry debt ratio

T_c : Average enterprise tax rate

The WACC is the "*the cost of financing and required return on capital*" which is "*based on private equity investors/fund"* required return on comparable projects" as presented in Option III, Item (30)(b) of version 06.0.0 of the"*Tool for the demonstration and assessment of additionality*". And it also reflects a common-practice approach in investment decision-making in Viet Nam as this approach was also introduced by the Ministry of Industry to conduct the financial analysis of IPP projects in Viet Nam[14]

The average industry debt ratio (D) is determined based on common practice in the Vietnamese hydropower industry and can be sourced from relevant regulations or guidances or other public sources. The average industry debt ratio will be revised and updated, as necessary, in later CPAs included in the PoA. The average equity ratio (D) is defined as E = 1 – D.

Determine the cost of debt

The cost of debt is determined as the interest rate for a long-term loan prevailing at the time of making the investment decision for the CPA in question, as published by sources such as State Bank of Viet Nam[15]. In case more than one interest rate is available, the CPA will choose the lowest value in order to ensure a conservative and standard value for the cost of debt.

Determine the cost of equity

To derive an appropriate cost of equity for electricity generation project type in Viet Nam, the well-known capital-asset pricing model (CAPM) is used[16].This model provides a standard formula relating the expected return on an asset to the asset's risk:

$$R_e = R_f + \beta * (R_{m,} - R_f) \qquad (2)$$

Where:

$R_{e,}$	cost of equity for electricity generation project type
R_f	Risk free rate return
β	Beta of the security for electricity generation project type
$R_{m,} - R_{f,}$	Market risk premium

<u>*Risk free rate:*</u>

The risk free rate is understood as the rate of return on an asset that is theoretically free of any risks. Under the CAPM the rate of interest on government bonds is considered as risk free rates. In the context of the Viet Nam Small Hydro PoA the risk free rate is equal to the long-term Vietnamese government bond rates available at the date of making the investment decision for the CPA in question. The data for Vietnamese government bond rates will be sourced from publicly available sources.

[14] Decision No. 2014/QĐ – BCN issued by the Ministry of Industry provides temporary guidelines for conducting the economic, financial and investment analysis and providing the purchasing-selling price frame for power generation projects.

[15] The State Bank of Viet Nam publishes interest rates for long-term loans on the following website: *www.sbv.gov.vn/.*

[16] The CAPM is used to determine a theoretically appropriate required rate of return of an asset, if that asset is to be added to an already well-diversified portfolio, given that asset's non-diversifiable risk. The model takes into account the asset's sensitivity to non-diversifiable risk (also known as systemic risk or market risk), often represented by the quantity beta (β) in the financial industry, as well as the expected return of the market and the expected return of a theoretical risk-free asset. See also Black, Fischer., Michael C. Jensen, and Myron Scholes (1972). The Capital Asset Pricing Model: Some Empirical Tests, pp. 79-121 in M. Jensen ed., Studies in the Theory of Capital Markets. New York: Praeger Publishers.

Beta:

Beta (β) indicates the sensitivity of the asset value to market risk factors. Beta represents the market risk for an asset and is calculated as the statistical measure of volatility of a specific asset/investment relative to the movement of a market group. The conventional approach for estimating beta of an investment is a regression of returns on investment against returns on a market index. For companies and project activities that are not publicly listed, the beta is determined by referring to beta values of publicly listed companies that are engaged in similar types of business. The project activity type considered under the Viet Nam Hydro PoA is power generation; therefore the applied beta for this project should be based on the beta values of listed power generation companies in Viet Nam.

In cases where the capital structure (Debt/Equity) between the listed companies and the CPA in question differs, the Beta applied for the benchmark has to be adjusted according to the following steps:

- Step 1 – The Levered Beta of all power generation companies listed on the Vietnamese stock exchange is obtained using publicly available data. This Levered Beta takes into account each power company's specific capital structure, including financial leveraging or gearing;
- Step 2 – The Levered Beta is unlevered using the average capital structure of the companies it comprises. This yields the Unlevered Beta, which represents the beta of a company without any debt. In other words, the unlevering of the beta removes the financial effects of leverage[17].
- Step 3 – The Unlevered Beta is levered again according to the assumed average industry debt-equity ratio (defined as D/E) for a typical hydropower project in Viet Nam at the date when the investment decision was made. This Levered Beta will be used to calculate the cost of equity element in the WACC.

Risk Premium:

The risk premium is calculated as the difference between average return on stocks and the risk free rate of return. The average return on stocks is defined as the compound annual rate (CAGR) of return of the Viet Nam stock exchange. The period considered for the analysis will be from 28 July 2000[18] to the date when the investment decision for the particular CPA was made.[19]

Substituting the values for R_f,R_m,and β into(2) yields the cost of equity for power generation projects in Viet Nam with a capital structure that corresponds to the capital structure of the CPA at the date when the investment decision for the CPA was made.This estimate of the cost of equity for the power generation sector meets the CDM EB rules because it reflects a sector-specific approach and is calculated based on similar companies operating in power generation sector in Viet Nam. Therefore the estimate is obtained from "*parameters that are standard in the market, considering the specific characteristics of the project type, but not linked to the subjective profitability expectation or risk profile of a particular project developer*" as stipulated in the guidance given in the latest additionality tool under sub-step 2b (5).

Determine average Enterprise Tax rate

[17] http://www.investopedia.com/terms/u/unleveredbeta.asp

[18] The date when the stock market in Viet Nam has started operation.

[19] The return of the Viet Nam stock exchange is estimated using the appropriate stock market index. At the time of registration of the Viet Nam Small Hydro PoA the VN Index was the most appropriate stock market index for Viet Nam.

In terms of enterprise tax, there are legal documents in Viet Nam prescribing general provisions on the implementation of enterprise tax. The investment certificate of each particular project, on the other hand, may also specify tax requirements imposed on the project.

Therefore, the CPAs will apply the provision on tax in the investment certificate in the case that investment decision is made during the validity period of such certificate and that there is no legal documents on enterprise tax published and taking effect after the date of issuance of the investment certificate.

If there are no provision on tax rate in the investment certificate, or the certificate has expired at the date of investment decision of the project, or there are new legal documents published and taking effect after the issuance of the investment certificate and before the date of investment decision, the latest legal documents on enterprise revenue tax shall be applied to calculate average enterprise tax rate in the investment analysis.

Sub-step 2c: Calculation and comparison of financial indicators

Project IRR calculations for a CPA will be based on a list of economic parameters provided by the owner of the CPA at the time of making the investment decision. This list of parameters includes:

Table 2: Key parameters for calculation of Project IRR

No	Parameter	Unit	Comment
1	Investment decision date	DD/MM/YY	Shall be based on investment decision making documents
2	Construction start date	Year	Shall be based on construction schedule or public sources or relevant documents
3	Date project starts operating	year	Shall be based on operation schedule or public sources or relevant documents
4	Installed capacity	MW	Shall be consistent with the Feasibility Study Report or Equipment Contract or relevant documents
5	Total investment cost	billion VND	Shall be consistent with study conducted by third party. If the construction is expected to last several years, a yearly breakdown of investments can be provided
6	Total annual O&M cost	%	Shall be based on the decision No. 2014/QĐ – BCN issued by the Ministry of Industry or its equivalent at the time of investment decision. Indicated as a percentage of the total investment cost.
7	Technical lifetime – period of financial assessment	Years	Based on the longest value among the lifetimes of the major technical components of the hydropower plant (e.g. turbine, generator, etc.). If not specified the project technical lifespan and the assessment period will be chosen as 20 years,

			asper *"Guidance on the Assessment of Investment Analysis" (Version 05)*, Annex 5, EB 62).[20]
8	Fair value	billion VND	Shall be considered as null because the period of financial assessment reflects the technical lifetime according to *"Guidance on Assessment of Investment Analysis"(version 05)*, Annex 5, EB 62.
9	Annual net electricity generation	MWh	Shall be consistent with the PLF and take into account parasitic loss and load loss.
10	Electricity price	VND/kWh	As per PPA if signed at date of investment or as per meeting minutes signed between EVN and the CPA Owners or relevant decisions by the Electricity Regulatory Authority on avoided cost tariff that are in force at the time of decision making.
11	Enterprise revenue tax: - For the first [XXX] years - For the next [XXX] years - ..... - For the remaining years	%	As per latest legal documents on enterprise revenue tax on the date of investment decision or investment licence/certificate, whichever later.
12	**Project IRR**	**%**	**XXX**

All economic and financial parameters for a CPA shall be sourced from documents that can be designed by a third party (e.g. hydropower technical consultant) and also independently validated by another third party and/or local authorities such as Department of Industry and Trade or Department of Investment.

A standardized excel worksheet has been developed into which data received from the CPA owner will be entered in a transparent manner, and which will in turn compute the project IRR from the cash flow. The said excel sheet has been supplied to the DOE for inspection. This spreadsheet will be used for all CPAs to be included in the PoA.[21]

For the eligibility of the CPA, its IRR shall be less than the commercial lending rate, or if the WACC is chosen as the appropriate benchmark the IRR shall be less than the WACC.

[20] If not specified otherwise in the financial documentation of a CPA, the deprecation rate will be chosen as 1/technical lifetime. The financial assessment period is equal to the technical lifetime.

[21] If over the course of the lifetime of the PoA, a parameter or its source become unavailable or are replaced by a more relevant or updated parameter and/or source, then this parameter and/or sources will be revised accordingly after prior agreement from the DOE.

Sub-step 2d: Sensitivity analysis

A sensitivity analysis will be also conducted to test the robustness of the results of the investment analysis conducted for a CPA. To this end the following parameters will be changed by ±10%[22], as they mainly influence the economic feasibility of the CPA:

- Annual amount of electricity exported to the national grid
- Feed in price set by EVN
- O&M cost
- Total investment cost

The full results of each sensitivity analysis will be reported in the respective CPA-DD using the following format:

Table 3: Framework for reporting results of sensitivity analysis

	IRR	Variation that hits the benchmark	Likelihood of hitting the benchmark
Annual amount of electricity exported to the national grid +10%			
Feed in price set by EVN +10%			
O&M cost -10%			
Total investment cost -10%			

If the sensitivity analysis shows that the project IRR of the CPA is lower than the benchmark in all cases then the results of the investment analysis are deemed robust. If the project IRR exceeds the benchmark under one or more scenarios calculated in the sensitivity analysis, the CPA owners shall provide evidence to demonstrate that such a scenario is unlikely to happen. If such demonstration cannot be substantiated with sufficient evidence the CPA will be considered as non-additional.

Step 3: Barrier analysis

This step will not be applied, except in cases where the results of the investment analysis are negative, and exceptional barriers exist that make a particular CPA additional pursuant to "Tool for the demonstration and assessment of additionality" - version 06.0.0.

[22] A ±10% band is consistent with Decision No. 709/QĐ – NLDK issued by the Ministry of Industry, dated 13 April 2004 to provide temporary guidelines for conducting the economic, financial and investment analysis and providing the purchasing-selling price frame for power generation projects. It is also common-practice for sensitivity analysis for additionality demonstration. Furthermore, ±10% is also a common practice rate for sensitivity analysis of a CDM project

Step 4: Common practice analysis

For the purpose of common practice analysis, hydropower projects in the whole Viet Nam are taken into account. Therefore, the entire host country is chosen as the applicable geographical area.

Sub-step 4a: Analyse other activities similar to the proposed project activity

According to the para 47 of the "Tool for the demonstration and assessment of additionalily", version 06.0.0, EB 65, the project activity falls in the type of "Switch of technology with or without change of energy source, including the use of renewable energies" which listed in the para 6 of the tool. Therefore, the following Steps wise approached according to the Additional Tool shall be applied to analyze the common practices for the proposed project.

Step 1: Calculate applicable output range as +/-50% of the design output or capacity of the proposed project activity.

Step 2: In the applicable geographical area, identify all plants that deliver the same output or capacity, within the applicable output range calculated in Step 1, as the proposed project activity and have started commercial operation before the start date of the project. Note their number N_{all}. Registered CDM project activities and projects activities undergoing validation shall not be included in this step;

Step 3: Within plants identified in Step 2, identify those that apply technologies different that the technology applied in the proposed project activity. Note their number N_{diff}.

Step 4: Calculate factor $F=1-N_{diff}/N_{all}$ representing the share of plants using technology similar to the technology used in the proposed project activity in all plants that deliver the same output or capacity as the proposed project activity.

The proposed project activity is a "common practice" within a sector in the applicable geographical area if both the following conditions are fulfilled:

(a) the factor F is greater than 0.2, and

(b) $N_{all}-N_{diff}$ is greater than 3.

If the CPA is not common practice as per sub-step 4b and if the CPA has been determined to be additional as per step 2 or 3 then the CPA will be considered additional and can be included in the Viet Nam Small Hydro PoA.

E.6. Estimation of Emission reductions of a CPA:

E.6.1. Explanation of methodological choices, provided in the approved baseline and monitoring methodology applied, selected for a typical CPA:

The reduced emission is calculated in accordance with the approved consolidated baseline methodology ACM0002, version 12.3.0.

I. Project emissions *(PE_y)*

According to the applied methodology, the project emissions are calculated using the following equation:

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y}$$

Where:

PE_y	Project emissions in year *y* (tCO_2e)
$PE_{FF,y}$	Project emissions from fossil fuel consumption in year *y* (tCO_2)
$PE_{GP,y}$	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases n year *y* (tCO_2e)
$PE_{HP,y}$	Project emissions from reservoirs of hydro power plants in year *y* (tCO_2e)

The proposed project is a hydro power plant that neither uses fossil fuel nor operates geothermal power plants (i.e. $PE_{FF,y} = 0$; $PE_{GP,y} = 0$); therefore, the above equation can be shortened as follows:

$$PE_y = PE_{HP,y}$$

Emissions from water reservoirs of hydro power plant ($PE_{HP,y}$)

For CPAs that result in new reservoirs and/or the increase of existing reservoirs, the power density (*PD*) of the CPA shall be calculated as follows:

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}}$$

Where:

PD	Power density of the CPA(W/m^2).
Cap_{PJ}	Installed capacity of the hydro power plant after the implementation of the CPA (W).
Cap_{BL}	Installed capacity of the hydro power plant before the implementation of the project activity (W). For new hydro power plants, this value is zero.
A_{PJ}	Area of the single or multiple reservoirs measured in the surface of the water, after the implementation of the CPA, when the reservoir is full (m^2).
A_{BL}	Area of the single or multiple reservoirs measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m^2). For new reservoirs, this value is zero.

If the *PD* is greater than 4 W/m^2 and less than or equal to 10 W/m^2:

$$PE_{HP,y} = \frac{EF_{Res} * TEG_y}{1000}$$

Where:

$PE_{HP,y}$	Project emission from reservoir of hydro power plants in year y (tCO_2e)
EF_{Res}	Default emission factor for emissions from reservoirs of hydropower plants ($kgCO_2e/MWh$).[23]

[23] Default value was 90 Kg CO_2e /MWh as per EB23.

TEG_y Total electricity produced by the CPA, including the electricity supplied to the grid and the electricity supplied to internal loads, in year *y* (MWh).

If *PD* is greater than 10 W/m^2, then:

$$PE_{HP,y} = 0$$

II. Baseline emissions (BE_y)

Baseline emissions include only CO_2 emissions from electricity generation from fossil fuel fired power plants that are displaced due to the CPA, calculated as follows:

$$BE_y = EG_{PJ,y} * EF_{grid,CM,y}$$

Where:

BE_y Baseline emissions in year *y* (tCO_2).

$EG_{PJ,y}$ Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CPA in year y (MWh).

$EF_{grid,CM,y}$ Combined margin CO_2 emission factor for grid connected power generation in year *y* calculated using the "Tool to calculate the emission factor for an electricity system"_version 02.2.1(tCO_2/MWh).

Calculation of $EG_{PJ,y}$

Because the project activity is the installation of a new grid-connected renewable power plant/unit at a site where no renewable power plant was operated prior to the implementation of the project activity, then:

$$EG_{PJ,y} = EG_{facility,y}$$

Where:

$EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh)

$EG_{facility,y}$ = Quantity of net electricity generation supplied by the project plant/unit to the grid in year y (MWh)

Therefore, the baseline emissions are calculated as follows:

$$BE_y = EG_{facility,y} . EF_{grid,CM,y}$$

Calculation of CO_2 emission factor of the national grid

The Version 02.2.1 of "Tool to calculate the emission factor for an electricity system" determines the CO_2 emission factor for the displacement of electricity generated by power plants in an electricity system, by calculating the "operating margin" and "build margin" as well as the "combined margin", including 6 steps as follows:

STEP 1. Identify the relevant electric power system.

STEP 2. Choose whether to include off-grid power plants in the project electricity system (optional).

STEP 3. Select a method to determine the operating margin (OM)

STEP 4. Calculate the operating margin emission factor according to the selected method.

STEP 5. Calculate the build margin (BM) emission factor.

STEP 6. Calculate the combined margin (CM) emission factor.

Step 1. Identify the relevant electricity systems

This hydropower project will be connected to the national electricity grid of Viet Nam, which is operated and monopolized by the EVN. This national electricity grid is the unique transmission and distribution line, to which all power plants in Viet Nam are physically connected. Hence the national electricity grid is the project electricity system.

There are electricity imports to the national electricity grid from China - another host country, thus the China Power Grid is the connected electricity system and the emission factor for the imported electricity is zero tons CO_2 per MWh by default.

Step 2: Choose whether to include off-grid power plants in the project electricity system (optional)

There are 2 options in the tools to choose, including:
Option I: Only grid power plants are included in the calculation.
Option II: Both grid power plants and off-grid power plants are included in the calculation.
Because only the data of grid connected power plants is available, so Option I will be chosen for calculating the grid emission factor.

Step 3. Select a method to determine the operating margin (OM)

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods:

a) Simple OM;

b) Simple adjusted OM;

c) Dispatch data analysis OM;

d) Average OM.

The simple OM method (a) has been used to determine the OM for the project activity because low-cost/must-run resources in Viet Nam is 34.77 % constituting less than 50% of total grid generation in average of the five most recent years (for details see the table below).

Table 4: Rate of low cost/must-run sources based on generation[24]

Year	2004	2005	2006	2007	2008	Average Value for 2004-2008
Hydro Power (MWh)	17,858,651	16,365,438	19,508,244	22,385,232	25,933,762	102,051,327
Total Power (MWh)	44,974,169	50,330,468	57,160,493	66,348,589	74,689,636	293,503,355
Low-cost/Must-run Ratio	39.71%	32.52%	34.13%	33.74%	34.72%	34.77%

The emission factor is calculated using the ex-ante option determined at the validation stage with no

[24] Data source from DNA Viet Nam

requirement for monitoring and recalculation during the crediting period. A 3-year generation-weighted average has been calculated with reference to years 2006, 2007 and 2008, which is the most recent data available at the time of submission of the CDM-PDD to the DOE for validation.

Since all grid connected power plants registered as CDM projects in Viet Nam are renewable energy projects (wind, hydro and biomass) there are no registered CDM projects in Viet Nam which satisfy the criteria for inclusion in the sample group.

Step 4. Calculate the OM emission factor according to the selected method

The simple OM emission factor is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system, not including low-cost/must-run power plants units.

There are two Options proposed, including:

Option A: Based on data on the net electricity generation and a CO2 emission factor of each power unit, or
Option B: Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

Because the data for Option A is available, Option A "*Calculation based on average efficiency and electricity generation of each plant"* is used and then the simple OM emission factor is calculated as follows:

$$EF_{grid,OMsimple,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}}$$

Where:

$EF_{grid,OM,y}$	= Simple operating margin CO_2 emission factor in year *y* (tCO_2/MWh)
$EG_{m,y}$	= Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
$EF_{EL,m,y}$	= CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
m	= All power plants/units serving the grid in year *y* except low-cost/must-run power plants/units
y	Either the three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option)

Because the data on fuel consumption and electricity generation of power unit *m* is available, so the emission factor ($EF_{EL,m,y}$) should be determined as **Option A1** :

$$EF_{EL,m,y} = \frac{\sum_i FC_{i,m,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_{m,y}}$$

Where:

$EF_{EL,m,y}$	= CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)

$FC_{i,m,y}$ = Amount of fossil fuel type *i* consumed by power plant/unit *m* in year *y* (mass or volume unit)

$NCV_{i,y}$ = Net calorific value (energy content) of fossil fuel type *i* in year *y* (GJ/mass or volume unit)

$EF_{CO2,i,y}$ = CO_2 emission factor of fossil fuel type *i* in year *y* (tCO_2/GJ)

$EG_{m,y}$ = Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost/must-run power plants/units, in year *y* (MWh)

i = All fossil fuel types combusted in power unit *m* in year *y*

y = The relevant year as per the data vintage chosen in Step 3

Table 5: OM emission factor in 2008

Year	Total output (MWh)	Total emission (tCO2e)	OM 2008 (tCO2e/MWh)
	A	**B**	**(ΣB/ΣA)**
2006	37,618,199.00	24,806,935	
2007	43,921,501.00	27,553,093	
2008	48,719,874.00	28,922,989	
Total	**130,259,574.00**	**81,283,018**	**0.6240**

So $EF_{grid,OMsimple,y}$ is derived as follows:

$$\boldsymbol{EF_{grid,OMsimple,y} = 0.6240\ tCO_2/MWh}$$

Step 5. Calculate the BM emission factor

In terms of vintage of data, one of the following two options can be chosen:

Option 1: For the first crediting period, calculate the build margin emission factor *ex ante* based on the most recent information available on units already built for sample group *m* at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period, or

Option 2: For the first crediting period, the build margin emission factor shall be updated annually, *ex post*, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated *ex ante*, as described in Option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used..

The most recent information on units already built for sample group *m* is available, so Option 1 shall be chosen for the proposed project.

The sample group of power units *m* used to determine as per the following procedure, consistent with the data vintage selected above:

(a) Identify the set of five power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently ($SET_{5\text{-units}}$) and determine their annual electricity generation ($AEG_{SET\text{-}5\text{-}units}$, in MWh);

In 2008, the set of five power units that have been built most recently ($SET_{5\text{-}units}$) is indicated in Annex 3 has annual generation ($AEG_{SET\text{-}5\text{-}units}$) of 7,829,812.02 MWh.

(b) Determine the annual electricity generation of the project electricity system, excluding power units registered as CDM project activities (AEG_{total}, in MWh). Identify the set of power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently and that comprise 20% of AEG_{total} (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) ($SET_{\geq 20\%}$) and determine their annual electricity generation ($AEG_{SET\text{-}\geq 20\%}$, in MWh);

The total output of Viet Nam electricity grid (AEG_{total}) in 2008 is 74,689,635.97 MWh then 20% of the total output of Viet Nam electricity grid in 2008 is 14,937,927.19 MWh.

Most recent-built power plants ($SET_{\geq 20\%}$) addition in the electricity system that comprise 20% of the system generation in 2008 is shown in the annex 3 have annual electricity generation ($AEG_{SET\text{-}\geq 20\%}$) of 16,514,761.12 MWh.

(c) From $SET_{5\text{-units}}$ and $SET_{\geq 20\%}$ select the set of power units that comprises the larger annual electricity generation (SET_{sample}).

The comparison carried out by the project participants shows that the set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) that have been built most recently has the larger annual generation (16,514,761.12 MWh) than the set of five power units that have been built most recently in 2008 does (7,829,812.02 MWh), and hence it is employed and SET_{sample}.

There is no plant in SET_{sample} is started to supply electricity to the grid more than 10 years ago, then use SET_{sample} to calculate the build margin.
The BM emissions factor is the generation-weighted average emission factor (tCO_2/MWh) of all power units *m* during the most recent year *y* for which power generation data is available. It is calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}}$$

Where:

$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year *y* (tCO_2/MWh)
$EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
$EF_{EL,m,y}$ = CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
m = Power units included in the build margin
y = Most recent historical year for which electricity generation data is available

Then $EF_{grid,BM,y}$ is derived as follows:

$$\boldsymbol{EF_{grid,BM,y} = 0.4875\ tCO_2/MWh}$$

Step 6. Calculate the combined margin emissions factor

According to the tool, the calculation of the combined margin (CM) emission factor ($EF_{grid, CM,y}$) is based on one of the following methods:

(a) Weighted average CM; or

(b) Simplified CM

As the project is located in Viet Nam a developing country and having more than 10 registered projects at starting date of validation, the PP chooses the weighted average CM method to calculate CM emission factor for the proposed project.

The CM emissions factor is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM}$$

Where:

$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year y (tCO_2/MWh)

$EF_{grid,OM,y}$ = Operating margin CO_2 emission factor in year y (tCO_2/MWh)

w_{OM} = Weighting of OM emissions factor (%)

w_{BM} = Weighting of BM emissions factor (%)

For the proposed project, the following default values are used: w_{OM}= 0.5 and w_{BM} = 0.5 in the first crediting period, and w_{OM}= 0.25 and w_{BM}= 0.75 in the second and third crediting period.

So in the first crediting period, the CM emission factor is derived as follows:

$$\boldsymbol{EF_{grid,CM,y} = 0.5 \times 0.6240 + 0.5 \times 0.4875 = 0.5558\ tCO_2/MWh}$$

The baseline emission factor EF shall be fixed for the crediting period.

III. Leakage *(LE_y)*

According to ACM0002_ version 12.3.0, no leakage emissions are considered. The main emissions potentially giving rise to leakage in the context of electric sector projects are emissions arising due to activities such as power plant construction and upstream emissions from fossil fuel use (e.g. extraction, processing, transport). These emissions sources are neglected.

IV. Emission reductions *(ER_y)*

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y$$

Where:

ER_y Emission reductions in year y (tCO_2e)

BE_y Baseline emissions in year y (tCO_2e)

PE_y Project emissions in year y (tCO_2)

E.6.2. Equations, including fixed parametric values, to be used for calculation of emission reductions of a CPA:

Data / Parameter:	EF_{Res}
Data unit:	kgCO2e/MWh
Description:	Default emission factor for emissions from reservoirs of hydro power plants
Source of data:	Decision by EB23
Value to be applied:	90 kgCO2e/MWh
Any comment:	Applicable to CPAs with a power density (PD) greater than 4 W/m^2 and less than or equal to 10 W/m^2.

Data / Parameter:	Cap_{BL}
Data unit:	MW
Description:	Installed capacity of hydropower plant before the implementation of the project activity.
Source of data used:	This is a green-field project. This value does not exist prior to the implementation of the project activity
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied :	The project activity constructs a new hydropower plant, so Cap_{BL} is considered as zero according to the applied methodology.
Any comment:	For calculating the power density (PD)

Data / Parameter:	A_{BL}
Data unit:	m^2
Description:	Area of the single or multiple reservoirs measured in the surface of the water, before the implementation of the project activity, when the reservoir is full. For new reservoirs, this value is zero.
Source of data used:	This is a green-field project. This value does not exist prior to the implementation of the project activity
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied :	The project activity builds a new single reservoir, so A_{BL} is considered as zero according to the applied methodology.
Any comment:	For calculating the power density (PD)

Data / Parameter:	$EF_{grid,OM,y}$
Data unit:	tCO_2/MWh

Description:	Operating margin CO_2 emission factor for grid connected power generation in year *y* calculated using the latest version of "Tool to calculate the emission factor for an electricity system".
Source of data used:	Database for EF calculation is provided and requested to be used by DNA Viet Nam.
Value applied:	0.6240
Justification of the choice of data or description of measurement methods and procedures actually applied:	As per the "Tool to calculate the emission factor for an electricity system"
Any comment:	For calculation of $\boldsymbol{EF}_{grid,CM,y}$

Data / Parameter:	$\mathbf{EF}_{grid,BM,y}$
Data unit:	tCO_2/MWh
Description:	Build margin CO_2 emission factor for grid connected power generation in year *y* calculated using the latest version of "Tool to calculate the emission factor for an electricity system"
Source of data used:	Database for EF calculation is provided and requested to be used by DNA Viet Nam
Value applied:	0.4875
Justification of the choice of data or description of measurement methods and procedures actually applied:	As per the "Tool to calculate the emission factor for an electricity system"
Any comment:	For calculation of $\boldsymbol{EF}_{grid,CM,y}$

Data / Parameter:	$\mathbf{EF}_{grid,CM,y}$
Data unit:	tCO_2/MWh
Description:	Combined margin CO_2 emission factor for grid connected power generation in year *y* calculated using the latest version of "Tool to calculate the emission factor for an electricity system".
Source of data used:	Database for EF calculation is provided and requested to be use by DNA Viet Nam
Value applied:	0.5558

Justification of the choice of data or description of measurement methods and procedures actually applied:	As per the "Tool to calculate the emission factor for an electricity system".
Any comment:	Fixed for crediting period.

E.6.3. Data and parameters that are to be reported in CDM-CPA-DD form:

Not applicable.

E.7. Application of the monitoring methodology and description of the monitoring plan:

E.7.1. Data and parameters to be monitored by each CPA:

Data/Parameter:	**$EG_{y, export}$**
Data unit:	MWh
Description:	Electricity supplied by the proposed CPA to the national grid, i.e. excluding the electricity generated by the proposed CPA used for internal consumption and losses.
Source of data to be used:	Direct measurement at the project connection point. .
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be specified in each CPA
Description of measurement methods and procedures to be applied:	Two-way power meters will be installed at the grid-connected point to measure the amount of electricity supplied and consumed by the proposed project. The readings of electricity meter will be hourly measured and monthly recorded. The recorded data will be confirmed by the joint balance sheet which will be signed by the representatives of EVN and the project owner. Electronic data will be archived within the crediting period and 2 years after the end of the crediting period.
Monitoring frequency	Continuous measurement and monthly recording
QA/QC procedures to be applied:	The uncertainty level of this data is low. The measurement/ monitoring equipment should be complied with national standard and technology. These equipment and systems should be calibrated and checked every 2 year.
Any comment:	For $EG_{facility,y} = EG_{y, export} - EG_{y, import,}$

Data / Parameter:	**$EG_{y, import}$**
Data unit:	MWh
Description:	Electricity supplied by the national grid to the proposed CPA
Source of data to be used:	Direct measurement at the project connection point
Value of data applied for the purpose of	To be specified in each CPA

calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Two-way power meters will be installed at the grid-connected point to measure the amount of electricity supplied and consumed by the proposed project. The readings of electricity meter will be hourly measured and monthly recorded. The recorded data will be confirmed by the joint balance sheet which will be signed by the representatives of EVN and the project owner. Electronic data will be archived within the crediting period and 2 years after the end of the crediting period.
Monitoring frequency	Continuous measurement and monthly recording
QA/QC procedures to be applied:	The uncertainty level of this data is low. The measurement/ monitoring equipment should be complied with national standard and technology. These equipment and systems should be calibrated and checked every 2 year.
Any comment:	For $EG_{facility,y} = EG_{y,\ export} - EG_{y,\ import}$

Data / Parameter:	**$EG_{facility,y}$**
Data unit:	MWh
Description:	Net electricity supplied to the national grid by the proposed project
Source of data to be used:	Calculating from $EG_{y,\ import}$ and $EG_{y,\ export}$. So $EG_{facility,y}$ has been excluded the electricity generated by the proposed project used for internal consumption and losses.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be specified in each CPA
Description of measurement methods and procedures to be applied:	Calculating by subtracting $EG_{y,\ import}$ from $EG_{y,\ export}$. Double checking by the joint balance sheet issued by EVN and project owner to ensure the consistency. Data will be archived within the crediting period and 2 years after the end of the crediting period.
Monitoring frequency	Continuous measurement and monthly recording
QA/QC procedures to be applied:	The uncertainty level of this data is low. The measurement/ monitoring equipment should be complied with national standard and technology. These equipment and systems should be calibrated and checked every 2 year.
Any comment:	For CERs calculation

Data / Parameter:	***TEG_y***
Data unit:	MWh
Description:	Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year *y*.
Source of data to be used:	To be specified in each CPA
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be specified in each CPA
Description of	Directly measured power meters will be installed at the grid-connected point to

measurement methods and procedures to be applied:	measure the amount of generated electricity. The readings of electricity meter will be hourly measured and monthly recorded. Electronic data will be archived within the crediting period and 2 years after the end of the crediting period.
Monitoring frequency	Continuous measurement and monthly recording
QA/QC procedures to be applied:	The uncertainty level of this data is low.
Any comment:	Applicable to CPAs with a power density (PD) greater than 4 W/m^2 and less than or equal to 10 W/m^2.

Data / Parameter:	$\mathbf{A_{PJ}}$
Data unit:	m^2
Description:	Area of the single or multiple reservoirs measured in the surface of the water, after the implementation of the project activity, when the reservoir is full.
Source of data to be used:	Feasibility Study
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be specified in each CPA
Description of measurement methods and procedures to be applied:	Measured from topographical surveys and maps yearly
Monitoring frequency	Yearly
QA/QC procedures to be applied:	The uncertainty level of this data is low.
Any comment:	For the calculation of PD

Data / Parameter:	$\boldsymbol{Cap_{PJ}}$
Data unit:	W
Description:	Installed capacity of the hydro power plant after the implementation of the project activity.
Source of data to be used:	Project site
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be specified in each CPA
Description of measurement methods and procedures to be applied:	Determine the installed capacity by taking photographs of the nameplates. And the value in nameplate will be included in the monitoring report.
Monitoring frequency	Yearly
QA/QC procedures to be applied:	The capacity of this project will not be changed. The monitoring of $\boldsymbol{Cap_{PJ}}$ will be taken yearly can will be confirmed by the Verifier
Any comment:	For the calculation of PD

E.7.2. Description of the monitoring plan for a CPA:

1. Monitoring Plan Objective and Organisation

The purpose of the monitoring plan is to measure the net electricity delivered to the local electricity grid by the CPA. The net electricity will be calculated by subtracting the electricity exported with the electricity imported by the CPA.

To ensure that the data is reliable and transparent, the CPA owner will establish Quality Assurance and Quality Control (QA&QC) measures to effectively control and manage data reading, recording, auditing as well as archiving data and all relevant documents.

2. Monitoring Data and archiving

Data to be monitored is the net electricity delivered to the local regional grid by the project. The monitoring data is derived from periodic electricity meter records kept by the project owners and/or the grid company, which are crosschecked with actual invoices sent by project owners to the grid company. The operator of the hydro plant will be responsible for collecting the monitoring data and will provide the CME with meter readings for electricity delivered and if available calibration certificates. Details of the CPA monitoring plan will be described for each CPA.

The data will be archived electronically and be stored for 2 years after the end of the crediting period of each CPA by the CME.

3. Calculation approaches
Calculation of ex-post emission reductions is carried out for each CPA as per following equation:

$$ER_{[CPA],y}=(EG_{[CPA],y,export} - EG_{[CPA],y,import}) * EF_{grid,CM,y} - PE_{[CPA],y}$$

Where:

$ER_{[CPA],y}$	Emission Reductions from [CPA] in year *y*; t CO_2
$EG_{[CPA],y,export}$	Electricity exported by [CPA] in year y; kWh
$EG_{[CPA],y,import}$	Electricity imported by [CPA] in year y; kWh
$EF_{grid,CM,y}$	CO_2 Emission Factor of the grid where the [CPA] is connected; t CO_2e/kWh
$PE_{[CPA],y}$	Project emissions from [CPA] in year *y* (tCO_2).

4. Quality Assurance and Quality Control

The installation location of the meters is detailed in each CPA. The CPA owner will implement QA&QC measures to calibrate and guarantee the accuracy of metering and safety of the project operation.
The metering devices will be calibrated and inspected properly and periodically as per standard industry norms and requirements. The grid company and the project owners are responsible for operation and maintenance of their respective electricity meters.

5. Verification of monitoring results

The responsibilities for verification of the projects are defined in each CPA. The CPA also defines the responsibility for providing the DOE with all required necessary information, before, during and in the event of queries, after the verification.

E.8. Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies)

Date: 21/9/2011
The responsible entities:
The baseline and monitoring sections have been prepared by Vietnam PoA Carbon Management Joint Stock Company and South Pole Carbon Asset Management Ltd.

Company name: Vietnam PoA Carbon Management Joint Stock Company
Contact person: Dang Hong Hanh
E-mail: dhanh@eec.vn

Company name: South Pole Carbon Asset Management Ltd.
Contact person: Francisco Koch
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Company name: South Pole Carbon Asset Management Ltd.
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Annex 1

CONTACT INFORMATION ON COORDINATING/MANAGING ENTITY and PARTICIPANTS IN THE PROGRAMME of ACTIVITIES

Organization:	Vietnam PoA Carbon Management Joint Stock Company
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

Viet Nam Small Hydro PoAdoes not receive public funding.

Annex 3

BASELINE INFORMATION

Data sources using to calculate $EF_{CM, grid}$ is provided and requested to be used by DNA Viet Nam.

Data of power plants in the Viet Nam national grid in 2006, 2007 and 2008

Table 6: Data for calculating of $EF_{grid, OM, 2006}$

Power Plant	Total electrictiy generation supply to the grid (MWh)	Main fuel consumed						Fuel included						Volume of emissions
		Type of fuel	Fuel consumption	Net calorific values		Emission factor of fuel		Type of fuel	Fuel consumption	Net calorific values		Emission factor of fuel		
			Coal, DO, FO: kt; Gas: mill.m3	Coal, DO, FO: kCal/kg; Gas: MJ/m3	Coal, DO, FO: GJ/kt; Gas: GJ/mill.m3	kg CO2/TJ	tCO2/GJ		Coal, DO, FO: kt; Gas: mill.m3	Coal, DO, FO: kCal/kg; Gas: MJ/m3	Coal, DO, FO: GJ/kt; Gas: GJ/mill.m3	kg CO2/TJ	tCO2/GJ	t CO2
A	B	C	D	E	Coal, DO, FO: F=E*4.1868 Gas: F=E*1000	G	H= G/10^6	I	J	K	L=K*4.1868	M	N= M/10^6	O=D*F*H +J*L*N
Coal-fired	**8,989,230**		**5,645.86**											**11,359,495**
Phả Lại 1	2,462,209	Coal	1,717	4,953	20,737	94,600	0.0946	FO	7.62	9,800	41,031	75500	0.0755	3,391,921
Phả Lại 2	3,696,205	Coal	1,951	5,039	21,097	94,600	0.0946	FO	3.76	9,800	41,031	75500	0.0755	3,905,457
Uông Bí	766,634	Coal	554	5,258	22,014	94,600	0.0946	FO	1.52	10,097	42,273	75500	0.0755	1,157,907
Uông Bí 2	0	Coal	0	0	0	94,600	0.0946	FO	0.00	0	0	75500	0.0755	0
Ninh Bình	721,277	Coal	440	5,421	22,697	94,600	0.0946	FO	0.09	10,376	43,442	75500	0.0755	945,313

Na Dương	641,510	Coal	514	4,006	16,770	94,600	0.0946	FO	0.35	7,496	31,386	75500	0.0755	816,283
Cao Ngạn	0	Coal	0	0	0	94,600	0.0946	FO	0.00	0	0	75500	0.0755	0
Formosa	701,395	OtherBituminousCoal	470	6,483	27,143	89,500	0.0895	FO	0.23	9,810	41,073	75500	0.0755	1,142,615
Gas Turbine	**26,542,978**		**5,813.38**											**12,081,953**
Gas-Turbine-Gas	***18,838,764***		***5,743.23528***											***11,851,782***
Bà Rịa	1,308,583	Gas	436.24	34.85	34,850	54,300	0.0543	-		0	0	0	0	825,524
Phú Mỹ	10,073,917	Gas	2,432.92	37.17	37,173	54,300	0.0543	-		0	0	0	0	4,910,834
		Gas	523.22	38.80	38,797	54,300	0.0543	-		0	0	0	0	1,102,253
Phú Mỹ 3	2,531,004	Gas	703.82	38.75	38,750	54,300	0.0543	-		0	0	0	0	1,480,929
Nhơn Trạch	0	Gas	0.00	0.00	0	54,300	0.0543	-		0	0	0	0	0
Cà Mau 1&2	0	Gas	0.00	0.00	0	54,300	0.0543	DO	0	10,050	42,077	72600	0.0726	0
Phú Mỹ 2.2	4,838,810	Gas	1,354.87	38.75	38,750	54,300	0.0543	-		0	0	0	0	2,850,809
VÊ ĐAN	47,894	Gas	236.67	42.80	42,800	54,300	0.0543	FO	1.09	9,665	40,465	75500	0.0755	553,370
Đạm Phú Mỹ	38,556	Gas	55.49	42.50	42,500	54,300	0.0543	-						128,062
Gas-Turbine-Oil	***233,582***		***70.14***											***230,171***
Bà Rịa	13,958	DO	4	10,300	43,124	72,600	0.0726	-			0	0	0	13,900
Phú Mỹ	67,721	DO	18	10,895	45,615	72,600	0.0726	-			0	0	0	60,637
Phú Mỹ 3	12,615	DO	3	10,255	42,936	72,600	0.0726	-			0	0	0	10,369
Phú Mỹ 2.2	0	DO	0	0	0	72,600	0.0726	-			0	0	0	0
CẦN THƠ	106,998	DO	33	10,860	45,469	72,600	0.0726	-			0	0	0	110,304
THỦ ĐỨC	32,290	DO	11	10,800	45,217	72,600	0.0726	-			0	0	0	34,962
Steam tail	***7,470,632***		***0***											***0***
Bà Rịa	660,965	Steam tail			0	0	0	-			0	0	0	0
Phú Mỹ	5,336,338	Steam tail			0	0	0	-			0	0	0	0

Phú Mỹ 3	1,473,329	Steam tail			0	0	0	-			0	0	0	0
Nhơn Trạch	0	Steam tail			0	0	0	-			0	0	0	0
Cà Mau 1&2	0	Steam tail			0	0	0	-			0	0	0	0
Phú Mỹ 2.2	0	Steam tail			0	0	0	-			0	0	0	0
Oil-fired	**1,043,991**		**397.65**											**1,295,034**
HIỆP PHƯỚC	453,303	FO	229	10,220	42,789	75,500	0.0755	DO	0.011	10,150	42,496	72600	0.0726	740,161
CẦN THƠ	118,748	FO	36	10,226	42,814	75,500	0.0755	DO	1.9693	10,860	45,469	72600	0.0726	122,939
THỦ ĐỨC	471,940	FO	133	10,300	43,124	75,500	0.0755	DO	0.132	10,800	45,217	72600	0.0726	431,933
Diesel FO	**80,000**		**16.60**											**50,374**
CÁI LÂN - VINASHIN	0	FO	0	0	0	75,500	0.0755	-			0	0	0	0
AMATA	80,000	FO	16.60	9,600	40,193	75,500	0.0755	-			0	0	0	50,374
Diesel DO	**25,000**		**6.39**											**20,080**
NM điện Đồng Khởi (Bến Tre)	3,150	DO	0.81	10,700	44,799	72,600	0.0726	-			0	0	0	2,621
NM điện Diesel Cà Mau	3,123	DO	0.83	10,970	45,929	72,600	0.0726	-			0	0	0	2,776
NM điện Diesel An Giang	1,505	DO	0.39	10,305	43,145	72,600	0.0726	-			0	0	0	1,222
Điện lực Đồng Tháp	119	DO	0.03	10,320	43,208	72,600	0.0726	-			0	0	0	107
Điện lực Bình Thuận	6,372	DO	1.54	10,150	42,496	72,600	0.0726	-			0	0	0	4,745
Diesel khác	10,732	DO	2.79	10,150	42,496	72,600	0.0726	-			0	0	0	8,609
Import	**937,000**	-			0	0	0	-			0	0	0	0

Total generated electricity	MWh	37,618,199

Total emissions	tCO2	24,806,935
Emission factor	tCO2/MWh	0.6594

Table 7: Data for calculating of $EF_{grid, OM, 2007}$

Power Plant	Total electricity generation supply to the grid (MWh)	Main fuel consumed						Fuel included						Volume of emissions
		Type of fuel	Fuel consumption	Net calorific values		Emission factor of fuel		Type of fuel	Fuel consumption	Net calorific values		Emission factor of fuel		
			Coal, DO, FO: kt; Gas: mill.m3	Coal, DO, FO: kCal/kg; Gas: MJ/m3	Coal, DO, FO: GJ/kt; Gas: GJ/mill.m3	kg CO2/ TJ	tCO2/ GJ		Coal, DO, FO: kt; Gas: mill.m3	Coal, DO, FO: kCal/kg; Gas: MJ/m3	Coal, DO, FO: GJ/kt; Gas: GJ/mill.m3	kg CO2/ TJ	tCO2/ GJ	t CO2
A	B	C	D	E	Coal, DO, FO: F=E*4.1868 Gas: F=E*1000	G	H= G/10^6	I	J	K	L=K*4.1868	M	N= M/10^6	O=D*F*H+J*L*N
Coal-fired	**9,836,548**		**6,386.09**											**12,753,376**
Phả Lại 1	2,501,117	Coal	1,728	4,946	20,708	94,600	0.0946	FO	6.59	9,800	41,031	75500	0.0755	3,405,500
Phả Lại 2	3,804,655	Coal	2,054	5,021	21,022	94,600	0.0946	FO	4.66	9,800	41,031	75500	0.0755	4,099,163
Uông Bí	705,798	Coal	526	5,210	21,813	94,600	0.0946	FO	1.74	11,975	50,137	75500	0.0755	1,091,402
Uông Bí 2	520,000	Coal	281	5,021	21,022	94,600	0.0946	FO	0.64	11,975	50,137	75500	0.0755	560,689
Ninh Bình	652,506	Coal	412	5,286	22,131	94,600	0.0946	FO	0.10	10,376	43,442	75500	0.0755	861,910
Na Dương	660,540	Coal	546	4,076	17,067	94,600	0.0946	FO	0.17	9,973	41,754	75500	0.0755	882,111
Cao Ngạn	352,577	Coal	330	4,980	20,850	94,600	0.0946	FO	1.52	9,800	41,031	75500	0.0755	654,693
Formosa	639,354	OtherBituminousCoal	511	6,259	26,205	89,500	0.0895	FO	0.11	9,802	41,039	75500	0.0755	1,197,908
Gas Turbine	**29,474,918**		**6,074.22**											**12,697,127**
Gas-Turbine-Gas	***20,023,591***		***5,910.94184***											***12,162,774***
Bà Rịa	1,244,019	Gas	416.89	34.85	34,850	54,300	0.0543	-		0	0	0	0	788,908
Phú Mỹ	10,700,737	Gas	3,040.39	36.99	36,988	54,300	0.0543	-		0	0	0	0	6,106,460
		Gas	99.85	38.49	38,486	54,300	0.0543	-		0	0	0	0	208,659

Phú Mỹ 3	2,393,620	Gas	665.69	38.56	38,560	54,300	0.0543	-		0	0	0	0	1,393,825
Nhơn Trạch	0	Gas	0.00	0.00	0	54,300	0.0543	-		0	0	0	0	0
Cà Mau 1&2	697,572	Gas	15.82	39.00	39,000	54,300	0.0543	DO	20.669	10,050	42,077	72600	0.0726	96,631
Phú Mỹ 2.2	4,942,360	Gas	1,383.86	38.56	38,560	54,300	0.0543	-		0	0	0	0	2,897,539
VÊ ĐAN	26,742	Gas	229.22	42.80	42,800	54,300	0.0543	FO	0.44	9,665	40,465	75500	0.0755	534,065
Đạm Phú Mỹ	18,542	Gas	59.23	42.50	42,500	54,300	0.0543	-			0	0	0	136,686
Gas-Turbine-Oil	***557,880***		***163.27***											***534,353***
Bà Rịa	80,828	DO	25.33	10,300	43,124	72,600	0.0726	-			0	0	0	79,318
Phú Mỹ	240,652	DO	64.92	10,895	45,615	72,600	0.0726	-			0	0	0	214,993
Phú Mỹ 3	17,278	DO	4.50	10,244	42,890	72,600	0.0726	-			0	0	0	14,027
Phú Mỹ 2.2	0	DO	0.00	0	0	72,600	0.0726	-			0	0	0	0
CẦN THƠ	148,862	DO	45.10	10,880	45,552	72,600	0.0726	-			0	0	0	149,165
THỦ ĐỨC	70,260	DO	23.41	10,800	45,217	72,600	0.0726	-			0	0	0	76,850
Steam tail	***8,893,447***		***0***											***0***
Bà Rịa	618,329	Steam tail			0	0	0	-			0	0	0	0
Phú Mỹ	5,986,286	Steam tail			0	0	0	-			0	0	0	0
Phú Mỹ 3	1,377,820	Steam tail			0	0	0	-			0	0	0	0
Nhơn Trạch	0	Steam tail			0	0	0	-			0	0	0	0
Cà Mau 1&2	911,012	Steam tail			0	0	0	-			0	0	0	0
Phú Mỹ 2.2	0	Steam tail			0	0	0	-			0	0	0	0
Oil-fired	**1,834,409**		**614.06**											**1,996,185**
HIỆP PHƯỚC	1,102,498	FO	410	10,196	42,690	75,500	0.0755	DO	0.018	10,150	42,496	72600	0.0726	1,322,437
CẦN THƠ	128,641	FO	38	10,215	42,768	75,500	0.0755	DO	3.1779	10,880	45,552	72600	0.0726	133,040
THỦ ĐỨC	603,270	FO	166	10,300	43,124	75,500	0.0755	DO	0.24	10,800	45,217	72600	0.0726	540,708

Diesel FO	**104,626**		**25.15**											**77,907**
CÁI LÂN - VINASHIN	104,626	FO	25.15	9,800	41,031	75,500	0.0755	-			0	0	0	77,907
AMATA	0	FO	0.00	9,600	40,193	75,500	0.0755	-			0	0	0	0
Diesel DO	**42,000.00**		**9.16**											**28,498.99**
NM điện Đồng Khởi (Bến Tre)	4,483.00	DO	1.14	10,700	44,799	72,600	0.0726	-			0	0	0	3,717
NM điện Diesel Cà Mau	6,820.60	DO	0.18	10,870	45,511	72,600	0.0726	-			0	0	0	588
NM điện Diesel An Giang	1,628.51	DO	0.42	10,305	43,145	72,600	0.0726	-			0	0	0	1,316
Điện lực Đồng Tháp	272.26	DO	0.08	10,320	43,208	72,600	0.0726	-			0	0	0	243
Điện lực Bình Thuận	7,246.00	DO	1.73	10,150	42,496	72,600	0.0726	-			0	0	0	5,349
Diesel khác	21,549.63	DO	5.60	10,150	42,496	72,600	0.0726	-			0	0	0	17,286
Import	**2,629,000**	-			0	0	0	-			0	0	0	0

Total generated electricity	MWh	43,921,501
Total emissions	tCO2	27,553,093
Emission factor	tCO2/MWh	0.6273

Table 8: Data for calculating of $EF_{grid, OM, 2008}$

Power Plant	Total electricity generation supply to the grid (MWh)	Main fuel consumed						Fuel included						Volume of emissions
		Type of fuel	Fuel consumption	Net calorific values		Emission factor of fuel		Type of fuel	Fuel consumption	Net calorific values		Emission factor of fuel		
			Coal, DO, FO: kt; Gas: mill.m3	Coal, DO, FO: kCal/kg; Gas: MJ/m3	Coal, DO, FO: GJ/kt; Gas: GJ/mill.m3	kg CO2/ TJ	tCO2/ GJ		Coal, DO, FO: kt; Gas: mill.m3	Coal, DO, FO: kCal/kg; Gas: MJ/m3	Coal, DO, FO: GJ/kt; Gas: GJ/mill.m3	kg CO2/ TJ	tCO2/ GJ	t CO2
A	B	C	D	E	Coal, DO, FO: F=E*4.1868 Gas: F=E*1000	G	H= G/10^6	I	J	K	L=K*4.1868	M	N= M/10^6	O=D*F*H+J*L*N
Coal-fired	**10,055,394**		**6,483.99**											**12,854,854**
Phả Lại 1	2,299,140	Coal	1,621	4,788	20,046	94,600	0.0946	FO	7.66	9,800	41,031	75500	0.0755	3,097,779
Phả Lại 2	3,929,218	Coal	2,081	4,995	20,913	94,600	0.0946	FO	4.05	9,800	41,031	75500	0.0755	4,129,534
Uông Bí	722,746	Coal	515	5,216	21,838	94,600	0.0946	FO	1.13	10,087	42,231	75500	0.0755	1,068,215
Uông Bí 2	532,000	Coal	282	4,995	20,913	94,600	0.0946	FO	0.55	10,087	42,231	75500	0.0755	559,172
Ninh Bình	675,372	Coal	431	5,191	21,734	94,600	0.0946	FO	0.16	10,376	43,442	75500	0.0755	887,373
Na Dương	627,930	Coal	532	4,034	16,889	94,600	0.0946	FO	0.20	9,923	41,545	75500	0.0755	850,587
Cao Ngạn	708,693	Coal	526	4,980	20,850	94,600	0.0946	FO	0.75	9,800	41,031	75500	0.0755	1,040,482
Formosa	560,295	OtherBituminousCoal	495	6,579	27,545	89,500	0.0895	FO	0.28	9,808	41,064	75500	0.0755	1,221,712
Gas Turbine	**33,857,135**		**6,893.46**											**14,245,795**
Gas-Turbine-Gas	***22,396,231***		***6,839.11484***											***14,067,937***
Bà Rịa	1,331,905	Gas	450.37	34.85	34,850	54,300	0.0543	-		0	0	0	0	852,263

Phú Mỹ	11,085,997	Gas	3,193.95	36.99	36,991	54,300	0.0543	-		0	0	0	0	6,415,396
		Gas	72.54	38.18	38,184	54,300	0.0543	-		0	0	0	0	150,402
Phú Mỹ 3	3,167,237	Gas	883.26	38.59	38,590	54,300	0.0543	-		0	0	0	0	1,850,807
Nhơn Trạch	544,809	Gas	166.38	40.50	40,500	54,300	0.0543	-		0	0	0	0	365,894
Cà Mau 1&2	2,106,807	Gas	647.24	39.00	39,000	54,300	0.0543	DO	4.417	10,050	42,077	72600	0.0726	1,384,155
Phú Mỹ 2.2	4,141,980	Gas	1,159.75	38.59	38,590	54,300	0.0543	-		0	0	0	0	2,430,192
VÊ ĐAN	12,780	Gas	209.48	42.80	42,800	54,300	0.0543	FO	0.79	9,665	40,465	75500	0.0755	489,253
Đạm Phú Mỹ	4,716	Gas	56.15	42.50	42,500	54,300	0.0543	-			0	0	0	129,573
Gas-Turbine-Oil	***183,088***		***54.35***											***177,858***
Bà Rịa	34,460	DO	10.64	10,300	43,124	72,600	0.0726	-			0	0	0	33,325
Phú Mỹ	69,324	DO	18.69	10,895	45,615	72,600	0.0726	-			0	0	0	61,895
Phú Mỹ 3	0	DO	0.00	10,246	42,898	72,600	0.0726	-			0	0	0	0
Phú Mỹ 2.2	0	DO	0.00	0	0	72,600	0.0726	-			0	0	0	0
CẦN THƠ	62,274	DO	19.39	10,890	45,594	72,600	0.0726	-			0	0	0	64,189
THỦ ĐỨC	17,030	DO	5.62	10,800	45,217	72,600	0.0726	-			0	0	0	18,449
Steam tail	***11,277,816***		***0***											***0***
Bà Rịa	658,459	Steam tail			0	0	0	-			0	0	0	0
Phú Mỹ	6,037,037	Steam tail			0	0	0	-			0	0	0	0
Phú Mỹ 3	1,853,448	Steam tail			0	0	0	-			0	0	0	0
Nhơn Trạch	0	Steam tail			0	0	0	-			0	0	0	0
Cà Mau 1&2	2,728,872	Steam tail			0	0	0	-			0	0	0	0
Phú Mỹ 2.2	0	Steam tail			0	0	0	-			0	0	0	0
Oil-fired	**1,481,880**		**534.59**	**30,715**	**128,598**	**226,500**	**0**	**0**	**4**	**31,840**	**133,308**	**217,800**		**1,741,069**

HIỆP PHƯỚC	877,631	FO	366	10,195	42,685	75,500	0.0755	DO	0.019	10,150	42,496	72600	0.0726	1,179,989
CẦN THƠ	66,709	FO	20	10,220	42,789	75,500	0.0755	DO	3.7286	10,890	45,594	72600	0.0726	76,804
THỦ ĐỨC	537,540	FO	149	10,300	43,124	75,500	0.0755	DO	0.228	10,800	45,217	72600	0.0726	484,277
Diesel FO	**90,465**		**22.48**											**69,633**
CÁI LÂN - VINASHIN	90,465	FO	22.48	9,800	41,031	75,500	0.0755	-			0	0	0	69,633
AMATA	0	FO	0.00	9,600	40,193	75,500	0.0755	-			0	0	0	0
Diesel DO	**15,000**		**3.73**											**11,638**
NM điện Đồng Khởi (Bến Tre)	860.00	DO	0.22	10,700	44,799	72,600	0.0726	-			0	0	0	719
NM điện Diesel Cà Mau	1,273.50	DO	0.33	10,940	45,804	72,600	0.0726	-			0	0	0	1,095
NM điện Diesel An Giang	252.86	DO	0.07	10,305	43,145	72,600	0.0726	-			0	0	0	219
Điện lực Đồng Tháp	51.25	DO	0.01	10,320	43,208	72,600	0.0726	-			0	0	0	45
Điện lực Bình Thuận	7,575.00	DO	1.80	10,150	42,496	72,600	0.0726	-			0	0	0	5,560
Diesel khác	4,987.39	DO	1.30	10,150	42,496	72,600	0.0726	-			0	0	0	4,001
Import	**3,220,000**	-			0	0	0	-			0	0	0	0

Total generated electricity	MWh	48,719,874
Total emissions	tCO2	28,922,989
Emission factor	tCO2/MWh	0.5937

Table 9: Data for calculating of $EF_{grid, BM, 2008}$

Total domestic electricity generation of Viet Nam Grid in 2008	**74,689,635.97**	**MWh**
20% of domestic electricity generation of Viet Nam Grid in 2008	**14,937,927.19**	**MWh**

Power Plant	Commission year	Grid-connected out put (MWh)	Main fuel						Included fuel						Volume of emissions
			Type of Fuel	Fuel consumed	Net calorific value		Emission factor of fuel		Type of Fuel	Fuel consumed	Net calorific value		Emission factor of fuel		
				Coal, DO, FO: kt; Gas: mill.m3	Coal, DO, FO: kCal/kg; Gas: MJ/m3	Coal, DO, FO: GJ/kt; Gas: GJ/mill.m3	kg CO2/TJ	tCO2/GJ		Coal, DO, FO: kt; Gas: mill.m3	Coal, DO, FO: kCal/kg; Gas: MJ/m3	Coal, DO, FO: GJ/kt; Gas: GJ/mill.m3	kg CO2/TJ	tCO2/GJ	t CO2
A	B	C	D	E	F	Coal, DO, FO: G=F*4.1868 Gas: G=F*1000	H	I= H/10^6	J	K	L	M=L*4.1868	N	O= N/10^6	P=E*G*I+K*M*O
5 most recently power plants															
A Vương	2008	168,103.50	Hydropower												
Tuyên Quang	2008	1,136,112.18	Hydropower												
Đại Ninh	2008	1,145,108.50	Hydropower												
Nhơn Trạch	2008	544,808.60	Gas	166.38	40.50	40,500	54300	0.0543	-		0	0	0	0	365,893.98
Cà Mau 1&2	2007	2,106,807.24	Gas	647.24	39.00	39,000	54300	0.0543	DO	4.417	10,050	42,077	72600	0.0726	1,384,155.38
		2,728,872.00	Đuôi hơi												
Total		**7,829,812.02**													
Most recently power plant capacity additions in the electricity system that comprise 20%															
A Vương	2008	168,103.50	Hydropower												
SROC Phu Mieng IDICO	2006	241,556.00	Hydropower												
SÊ SAN 3A	2006	394,895.70	Hydropower												
Tuyên Quang	2008	1,136,112.18	Hydropower												
Đại Ninh	2008	1,145,108.50	Hydropower												
SÊ SAN 3	2006	1,131,614.00	Hydropower												
Quảng Trị	2007	250,804.40	Hydropower												

Uông Bí 2	2007	532,000.00	Coal	281.759	4,995	20,913	94600	0.0946	FO	*0.548*	*10,087*	42,231	75500	0.0755	559,171.64
Na Dương	2005	627,930.00	Coal	532	4,034	16,889	94600	0.0946	FO	0.20	9,923	41,545	75500	0.0755	850,586.89
Cao Ngạn	2007	708,693.00	Coal	526	4,980	20,850	94600	0.0946	FO	0.75	9,800	41,031	75500	0.0755	1,040,481.82
Nhơn Trạch	2008	544,808.60	Gas	166.38	40.50	40,500	54300	0.0543	-		0	0	0	0	365,893.98
Cà Mau 1&2	2007	2,106,807.24	Gas	647.24	39.00	39,000	54300	0.0543	DO	4.417	10,050	42,077	72600	0.0726	1,384,155.38
		2,728,872.00	Đuôi hơi												
Đạm Phú Mỹ	2006	4,716.00	Gas	56.15	42.50	42,500	54300	0.0543	-			0	0	0	129,573.24
CÁI LÂN - VINASHIN	2007	90,465.01	FO	22.48	9,800	41,031	75500	0.0755	-			0	0	0	69,632.65
Formosa	2004	560,295.00	OtherBituminousCoal	495	6,579	27,545	89500	0.0895	FO	0.28	9,808	41,064	75500	0.0755	1,221,712.26
Phú Mỹ 2.2	2004	4,141,980.00	Gas	1,159.75	38.59	38,590	54300	0.0543	-		0	0	0	0	2,430,192.28
Total		**16,514,761.12**													**8,051,400.14**

Total generated electricity	MWh	16,514,761.12
Total emissions	tCO2	8,051,400.14
Emission factor	tCO2/MWh	0.4875

Table 10: CO_2 emission factor according to IPCC

Fuel Type	Default Carbon Content (kg/GJ)	Default Carbon Oxidation Factor	Emission factor CO2 (kg/TJ)		
			Default Value	95% Confidence interval	
				Lower[25]	Upper
Gas/Diesel DO	20.2	1	74,100	72,600	74,800
Fuel FO	21.1	1	77,400	75,500	78,800
Anthracite Coal	26.8	1	98,300	94,600	101,000
Bitum Coal types	25.8	1	94,600	89,500	99,700
Natural Gas	15.3	1	56,100	54,300	58,300

[25] The lower value has been used to calculate the Grid Emission Factor for conservative

Annex 4

MONITORING INFORMATION

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